VOL. LXXXII JANUARY, 1933 N.S. VOL. 35, No. 1

JOURNAL
of the
American Veterinary Medical Association

EDITED AND PUBLISHED FOR
The American Veterinary Medical Association

CONTENTS

$4.00 per annum Foreign $5.00; Canada $4.50 Single Copies 40 cts. in U. S.

Published monthly at 1230 W. Washington Blvd., Chicago, Ill. Entered as Second Class Matter, August 10, 1932, at the Post Office at Chicago, Illinois, under the Act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in Section 1103, Act of February 28, 1925, authorized August 10, 1932.

JOURNAL
of the
American Veterinary Medical Association
Formerly AMERICAN VETERINARY REVIEW
(Original Official Organ U. S. Vet. Med. Assn.)
H. Preston Hoskins, Secretary-Editor, 1230 W. Washington Blvd., Chicago, Ill.

Vol. LXXXII, N. S. Vol. 35 JANUARY, 1933 No. 1

ONE HUNDRED YEARS OF HOG CHOLERA

Most authorities agree in stating that hog cholera made its first appearance in the United States in the year 1833. With the advent of the year 1933, we begin to realize that hog cholera has been with us for a century. Unlike many of the centennials that have been celebrated during recent years, there is no rejoicing in the admission that the swine industry of this country has tolerated the existence of hog cholera for one hundred years. On the other hand, it is something we would like to forget about.

Many interesting thoughts arise as we mentally review the history of hog cholera in the United States, especially in its relation to the veterinary profession, and particularly during the past three decades. It was in 1903 that de Schweinitz and Dorset, of the United States Bureau of Animal Industry, demonstrated that the specific etiological agent of hog cholera was a filtrable virus, and not the hog cholera bacillus now named *Salmonella suipestifer*, and thereby perpetuating the name of Dr. Daniel Elmer Salmon, first chief of the U. S. Bureau of Animal Industry, under whose direction the earlier researches on hog cholera were conducted.

It was five years later, in 1908, that Dorset, Niles and McBryde completed experiments to produce an antiserum along the lines that had been used by other investigators in producing an

antirinderpest serum. The crude methods employed in the preparation of the serum in those pioneer days rather shock our esthetics as we contrast them with the methods in use today. Judged as finished products, there is almost as much difference between a bottle of the old defibrinated blood of 1908 vintage and a bottle of clear serum dated 1933, as there is between the old stage coach and a 1933 model automobile.

Paralleling the improvements and refinements made in the production of anti-hog cholera serum there have been other developments closely related. The law under which veterinary biological products are licensed was enacted, in large measure, to insure some degree of care in the production and testing of anti-hog cholera serum, which has come to be the most extensively used biological product in the world. Large laboratories have been built and equipped to produce this one biological product. Improvements in the veterinary hypodermic syringe, as well as other pieces of apparatus, are directly attributable to the development of anti-hog cholera serum and its wide use. Twenty years ago there was not available a smooth-working, large-capacity, American-made, veterinary hypodermic syringe.

With a means at hand for controlling hog cholera, veterinarians began to take a real interest in the diseases of hogs, and swine practice, particularly in the Corn Belt, soon began to take on large proportions. There was the period when practically every ailment of swine was diagnosed as hog cholera. This was followed by a period when veterinarians began to realize that there were other diseases of swine besides cholera. Differential diagnosis then had its fling, and necrobacillosis and hog flu assumed places of importance.

Perhaps it was natural that, with a better general understanding of hog cholera and an apparently simple weapon available for fighting it, many who lacked a scientific training assumed that they were capable of immunizing hogs against cholera, and the next thing was lay vaccination with all its attendant evils. Hog cholera probably will continue to menace the swine industry just as long as certain states permit the promiscuous distribution and indiscriminate use of anti-hog cholera serum and virus. It might be rather difficult to fix the responsibility for the present situation, but the fact remains that there is entirely too much hog cholera in spite of what the economists say to the contrary. For at least fifteen years the veterinary profession has been in a position to put hog cholera into the category of rare diseases, but has not been given an opportunity to do so. If the

use of virus continues to be "wide open," there is no reason to believe that hog cholera will not be just as prevalent in the year 2033, as it has been in recent years.

TWO IMPORTANT ANNOUNCEMENTS

The first concerns the 1933 convention. The Chicago Veterinary Medical Association, which sponsored the invitation for the A. V. M. A. to meet in the Windy City this year, has selected Dr. J. V. Lacroix, editor of the *North American Veterinarian*, to head the Committee on Local Arrangements. A meeting of subcommittee chairmen is scheduled for early in January, for the purpose of completing the organization of the Committee, the full personnel of which will be announced in the February issue of the JOURNAL.

The second announcement concerns the twelfth International Veterinary Congress, to be held in New York City in 1934. The dates have been tentatively fixed for August 13-18, 1934. The official headquarters will be at the Waldorf Astoria Hotel. Dr. O. E. McKim, of Port Chester, N. Y., will act as chairman of the Committee on Local Arrangements. Dr. Adolph Eichhorn, chairman of the Organizing Committee, who recently returned from Europe, reports that there is no disposition, upon the part of those veterinarians interviewed, to postpone the Congress, as has been suggested, on account of the unsettled condition of world affairs. Therefore, the plans will go ahead as previously arranged.

INTERESTING LETTERS

The past month brought an unusually large number of interesting letters. Quite a number of these were written by members when forwarding their dues for 1933. Right here it might be of interest for us to record the fact that about forty members did not wait to receive their notices that the dues for 1933 were payable, but forwarded these dues without any solicitation. Fine spirit.

As was shown in the report of the Secretary, made at the Atlanta meeting, approximately 600 members had not paid their 1932 dues at the time the report was compiled. However, since that time the number of members with 1932 dues unpaid has been reduced to slightly over the 400 mark. One of the interesting letters received was written by a member who had not been able to take care of his 1932 dues until recently. His letter was

representative of quite a number that had been received previously. Among other things, this member wrote:

> Enclosed find my check for five dollars to pay dues for this year. Money has been very scarce, but I have refused no one service. Business is good and I think from now on we can look for improvement.

Another member, who had been unable to remit his dues until the latter part of November, made the following significant notation on his dues notice when he returned it with his check:

> Hops have jumped in price from twelve to thirty cents and I received an avalanche of checks. Horses of uncertain years, and uncertain capabilities as farm animals, are patched up and tried for service. Pigs, six weeks old, going at one dollar. Tractors fewer and fewer.

Just the opposite condition of affairs is reflected in a letter received from a Michigan veterinarian who appears to be located in a territory where crops are plentiful, but money scarce. This member wrote as follows:

> As soon as I can collect any money I will pay my dues. As it is, I can collect plenty of potatoes, beef, pork and farm produce, but not even enough money to buy gas for my car. . . . Please do not consider this a hard luck story. We are all well and later on some of my clients will pay. Until they can, I must be content to know that we have our health and enough to eat and keep warm with.

A Missouri member finds himself in a situation that is quite similar to the foregoing. Like many other veterinarians, this member has continued to render service whenever called upon to do so, even though there was little or no prospect of being paid for his services. This member wrote:

> My clientele consists of a lot of farmers as honest as any in the country, but you cannot press blood out of turnips. The poor devils simply have no money and no way to get any and it is imperative that I trim my sails accordingly.

With the approach of Christmas, holiday greetings were received from scores of members, these being sent in various forms. Some sent cards, some sent letters and others penned greetings on dues notices. One of the nicest letters in this group was received from a member in Iowa. His message was as follows:

> Permit me to extend to you, your loved ones and those employees of our Association in your office, a very Merry Christmas and a prosperous 1933.

A member in Mississippi forwarded a clipping from his local newspaper, containing an article on hog cholera, written by a county agent. This article contained an interesting statement to the effect that hog cholera is caused by the cholera bacillus. The following day, a letter was received from another veteri-

narian, stating that he had been approached by his county agent with a proposition in connection with an equine parasite eradication campaign. The interesting part of the proposition was that the county agent wanted to "line up" horses for the veterinarian to treat on a fee-splitting basis.

While on the subject of county agents, we might mention another clipping received, containing an article that apparently emanated from a college of agriculture in the South, suggesting that "farmers who are inexperienced in administering a vermifuge for the control of stomach worms, should consult their county agent and have him arrange a demonstration where all the farmers in the neighborhood may learn how to drench ewes."

Next is a letter from a member in Ohio who had his funds tied up in a closed bank. After waiting patiently several months for the bank officials to do something, this veterinarian got tired waiting, organized a committee from among the depositors, and worked out a plan for reorganizing the bank that was satisfactory to both stockholders and depositors. On December 15, the bank opened as a solvent institution and nearly $20,000 was made available to the community. Name and address of this veterinarian-banker on request.

It would be possible to go on almost endlessly quoting from the hundreds of letters received from our members in all parts of the country, in fact, the world. Here is a card with holiday greetings from Sir Arnold and Lady Theiler, of Lucerne, Switzerland, and another from Major and Mrs. G. W. Dunkin, of Mill Hill, England. Here is a pretty calendar bearing the name of the Toronto Humane Society, sent by our good friend Dr. J. A. Campbell of that city. Many, many thanks for these tokens of good will. And for the letters, too.

May 1933 treat you better than did 1932.

It is quite likely that the JOURNAL will be able to announce the appointment of a number of new state veterinarians in the next issue. It is just too bad that politics continue to dominate these appointments in most states The sooner these offices are divorced from politics the better off the live stock industry will be. Some form of civil service would be much preferable.

A suburban matron recently had her dog's tonsils removed, and reported that she had had it done "because the little fellow had a headache for days."

EXTENDED ITINERARY FOR PRESIDENT WILLIAMS

Quite an extended schedule has been arranged for President Williams, in connection with his attendance at a number of veterinary meetings to be held in different parts of the country, during the month of January. Present indications are that he will be on the road for approximately three weeks during the month.

According to present plans, President Williams will attend the meeting of the State Veterinary Medical Association of Texas, in San Antonio, on January 5 and 6. He will be back in Fort Worth on January 7 and will leave the following evening for Oklahoma City, to attend the meeting of the Oklahoma Veterinary Medical Association, January 9 and 10. He will then start eastward for Columbus, Ohio, where he will attend the meeting of the Ohio State Veterinary Medical Association on January 11 and 12. From Columbus, President Williams will go to Ithaca, New York, where he will attend the annual Conference for Veterinarians at Cornell University. This event is scheduled for January 12 and 13, but President Williams will be compelled to miss the first day of the conference.

Monday morning, January 16, will find President Williams in Trenton, for the meeting of the Veterinary Medical Association of New Jersey. Late that evening, he will start westward and arrive in Indianapolis the afternoon of January 17 and will attend the meeting of the Indiana State Veterinary Medical Association. He will leave Indianapolis the following morning, January 18, for Wichita, Kansas, where he is scheduled to attend the meeting of the Kansas Veterinary Medical Association on January 19. He will arrive back in Fort Worth on January 20, rest up for a couple of days and then start out again.

The fourth week in January will find President Williams in Memphis, to attend the meeting of the Tennessee Veterinary Medical Association, January 24 and 25. Later in the week he will be in Jackson, for the meeting of the Mississippi State Veterinary Medical Association, January 27-28. It is just possible that he may be able to attend the meeting of the Arkansas Veterinary Medical Association, in Little Rock, the middle of the week, if plans can be arranged to that end.

It has been necessary for President Williams to decline a number of invitations, owing to conflicting dates or for other reasons. It is hoped that another trip can be arranged that will enable him to attend the summer meetings of several state associations.

TWO MORE STATES VOTE TO AFFILIATE

Information recently received from Dr. T. E. Munce, chairman of the A. V. M. A. Special Committee on Affiliation, indicates that two more state associations have approved the plan for affiliation between the A. V. M. A. and state, territorial and provincial associations, bringing the number up to twenty-eight. The Maine State Veterinary Medical Association voted to affiliate at the meeting held October 12, and the Maryland State Veterinary Medical Association approved the plan at the annual meeting held on December 8. As matters now stand, the approval of only two more associations is needed to make the plan operative. The list of associations which had previously approved the plan for affiliation was incorporated in the report of the Committee, published in the October, 1932, issue of the JOURNAL (pages 481-483).

EXECUTIVE BOARD ELECTION

Almost two hundred members have failed to return the ballots sent them in connection with the special election being held in Executive Board District 8, for the purpose of electing a successor to Dr. N. F. Williams, who resigned following his election to the presidency of the A. V. M. A. at Atlanta. The ballots which have not been cast probably would be sufficient to elect any one of the five nominees, if cast for the same one. As the polls for the election will not close until January 7, time remains for those members who have not yet voted to forward their ballots. We repeat the statement which has been made on previous similar occasions: Executive Board elections offer an opportunity to stay at home and vote. If you are located in any one of the states comprising District 8 (Arkansas, Louisiana, Texas, Missouri, Kansas and Oklahoma) and have not voted, do so at once.

APPLICATIONS FOR MEMBERSHIP

During the year just closed, there were 102 applications for membership listed in the JOURNAL. Everything considered, the results of 1932 are encouraging. There was little or nothing done in the shape of a membership campaign. The great majority of the applications filed were secured with little effort. Quite a number were purely voluntary, in the strict sense of the

word. This is the ideal situation. New members should be attracted into the Association rather than pushed in under the stimulus of a high-pressure membership drive. It has been observed in most organizations that members who join of their own accord are much more likely to "stick" than those who join under pressure.

Do not forget the rules and regulations for filing applications. They are simple:

> Applications for membership shall be made upon blanks furnished by the Association, in the handwriting of the applicant, and must be endorsed by two members of the Association in good standing, one of whom must be a resident of the state, province or territory in which the applicant resides. Applications must be accompanied by a membership fee of $5.00 and dues pro rata for the balance of the fiscal year current, as stated on the application blank. Applications must be filed with the Secretary and examined by him for correctness and completeness as far as available information will allow. After such approval by the Secretary, the latter will cause to be published in the official JOURNAL, as soon thereafter as possible, said application with name and address of the applicant, college and year of graduation, and names of vouchers. If no objections shall be filed with the Secretary, as against the applicant being admitted to membership in the Association. his name shall again be listed in the next issue of the JOURNAL, and if no objections shall have been filed within thirty days after the second publication of the name of the applicant, he shall automatically become a member and shall be so enrolled by the Secretary and membership card issued. If any obpections be filed against any applicant, either on first or second notice, said application will be referred to the Executive Board for consideration.

FIRST LISTING

GLUECK, OSCAR — Blue Point, L. I., N. Y.
D. M. V., Royal Hungarian Veterinary College, 1908
Vouchers: J. Elliott Crawford and Chas. Thompson Fake.

PURMELL, LOUIS C. — 1810 First Ave., New York, N. Y.
D. V. M., United States College of Veterinary Surgeons, 1923
D. V. M., Cornell University, 1932
Vouchers: Raymond J. Garbutt and C. P. Zepp.

Applications Pending

SECOND LISTING

(See December, 1932, JOURNAL)

Case, John D., Jr., West Main St., Clinton, N. J.
Fuller, Jack G., Cornell University, Ithaca, N. Y.
McMahon, Frank D., 337 N. Sixth Ave., Phoenix, Ariz.
Skidmore, Louis V., Dept. of Ani. Path. & Hygiene, Coll. of Agr., University of Nebraska, Lincoln, Nebr.
Tabbut, Herbert M., Dept. of Veterinary Anatomy, Iowa State College, Ames, Iowa.

The amount which should accompany an application filed this month is $10.00, which covers membership fee and dues to January 1, 1934, including subscription to the JOURNAL.

COMING VETERINARY MEETINGS

New York City, Veterinary Medical Association of. Academy of Medicine, 5th Ave. & 103rd St., New York, N. Y. January 4, 1933. Dr. John E. Crawford, Secretary, 708 Beach 19th St., Far Rockaway, Long Island, N. Y.

San Diego-Imperial Veterinary Medical Association. San Diego, Calif. January 4, 1933. Dr. A. P. Immenschuh, Secretary, Santee, Calif.

Pennsylvania, Conference for Veterinarians at University of. School of Veterinary Medicine, University of Pennsylvania. Philadelphia, Pa. January 4-5, 1933. Dr. G. A. Dick, Dean, 39th St. & Woodland Ave., Philadelphia, Pa.

California State Veterinary Medical Association and University of California Veterinary Conference. University Farm, Davis, Calif. January 4-7, 1933. Dr. Geo. M. Simmons, Secretary, 1386 Golden Gate Ave., San Francisco, Calif.

Western Michigan Veterinary Medical Association. Grand Rapids, Mich. January 5, 1933. Dr. Chas. H. Haasjes, Secretary, 728 S. State St., Shelby, Mich.

Texas, State Veterinary Medical Association of. Plaza Hotel, San Antonio, Tex. January 5-6, 1933. Dr. D. Pearce, Secretary, Box 335, Leonard, Tex.

Interstate Veterinary Medical Association. Elks Bldg., Omaha, Neb. January 9, 1933. Dr. G. L. Taylor, Secretary, Plattsmouth, Neb.

Oklahoma Veterinary Medical Association. Skirvin Hotel, Oklahoma City, Okla. January 9-10, 1933. Dr. C. H. Fauks, Secretary, 1919 W. Ash St., Oklahoma City, Okla.

Intermountain Livestock Sanitary Association. Ogden, Utah. January 9-11, 1933. Dr. D. E. Madsen, Secretary, Utah Experiment Station, Logan, Utah.

Chicago Veterinary Medical Association. Hotel La Salle, Chicago, Ill. January 10, 1933. Dr. E. E. Sweebe, Secretary, 14th St. & Sheridan Road, North Chicago, Ill.

Northwestern Missouri Veterinary Medical Association. Tarkio, Mo. January 10, 1933. Dr. R. L. Cundall, Secretary, Fairfax, Mo.

Rhode Island Veterinary Medical Association. State House, Providence, R. I. January 10, 1933. Dr. J. S. Barber, Secretary, 14 Washington St., Central Falls, R. I.

Wisconsin Veterinary Medical Association. Madison, Wis. January 10-11, 1933. Dr. B. A. Beach, Secretary, University of Wisconsin, Madison, Wis.

Iowa Veterinary Medical Association. Hotel Savery, Des Moines, Iowa. January 10-12, 1933. Dr. C. J. Scott, Secretary, Knoxville, Iowa.

Maine Veterinary Medical Association. State House, Augusta, Me. January 11, 1933. Dr. L. E. Maddocks, Secretary, R. F. D. 2, Augusta, Me.

Southeastern Michigan Veterinary Medical Association. Detroit, Mich. January 11, 1933. Dr. A. S. Schlingman, Secretary, Parke, Davis & Co., Detroit, Mich.

Ohio State Veterinary Medical Association. Neil House, Columbus, Ohio. January 11-12, 1933. Dr. R. E. Rebrassier, Secretary, Ohio State University, Columbus, Ohio.

Tulsa County Veterinary Association. Tulsa, Okla. January 12, 1933. Dr. J. M. Higgins, Secretary, 3305 E. 11th St., Tulsa, Okla.

Cornell University, Annual Conference for Veterinarians at. New York State Veterinary College, Ithaca, N. Y. January 12-13, 1933. Dr. W. A. Hagan, Dean, Cornell University, Ithaca, N. Y.

Minnesota State Veterinary Medical Society. West Hotel, Minneapolis, Minn. January 12-13, 1933. Dr. C. P. Fitch, Secretary, University Farm, Saint Paul, Minn.

New Jersey, Veterinary Medical Association of Hotel Hilderbrecht, Trenton, N. J. January 16-17, 1933. Dr. John G. Hardenbergh, Secretary, c/o Walker-Gordon Lab. Co., Plainsboro, N. J.

Kansas City Veterinary Association. Baltimore Hotel, Kansas City, Mo. January 17, 1933. Dr. J. D. Ray, Secretary, 1103 E. 47th St., Kansas City, Mo.

Indiana Veterinary Medical Association. Severin Hotel, Indianapolis, Ind. January 17-18, 1933. Dr. W. B. Craig, Secretary, 1420 N. Alabama St., Indianapolis, Ind.

Southern California Veterinary Medical Association. Chamber of Commerce Bldg., Los Angeles, Calif. January 18, 1933. Dr. E. E. Jones, Secretary, 1451 Mirasol St., Los Angeles, Calif.

Kansas Veterinary Medical Association. Lassen Hotel, Wichita, Kan. January 18-19, 1933. Dr. Chas. W. Bower, Secretary, 1128 Kansas Ave., Topeka, Kan.

Colorado Veterinary Medical Association. Albany Hotel, Denver, Colo. January 19, 1933. Dr. Floyd Cross, Secretary, Fort Collins, Colo.

Virginia Polytechnic Institute, Conference for Graduate Veterinarians at. Blacksburg, Va. January 23-25, 1933. Dr. I. D. Wilson, Virginia Polytechnic Institute, Blacksburg, Va.

Michigan State College Short Course for Veterinarians. Michigan State College, East Lansing, Mich. January 23-27, 1933. Dr. Ward Giltner, Dean, Michigan State College, East Lansing, Mich.

South Carolina Association of Veterinarians. Jefferson Hotel, Columbia, S. C. January 24, 1933. Dr. G. J. Lawhon, Hartsville, S. C.

Tennessee Veterinary Medical Association. Memphis, Tenn. January 24-25, 1933. Dr. A. C. Topmiller, Secretary, Box 238, Murfreesboro, Tenn.

Missouri Veterinary Medical Association and Special Course for Graduate Veterinarians. University of Missouri, Columbia, Mo. January 24-27, 1933. Dr. J. D. Ray, Secretary, 1103 E. 47th St., Kansas City, Mo.

Keystone Veterinary Medical Association. Philadelphia, Pa. January 25, 1933. Dr. C. S. Rockwell, Secretary, 5225 Spruce St., Philadelphia, Pa.

Mississippi State Veterinary Medical Association. Robert E. Lee Hotel, Jackson, Miss. January 27-28, 1933. Dr. E. H. Durr, Secretary, Box 725, Jackson, Miss.

Nevada State Veterinary Association. Reno, Nev. January 31, 1933. Dr. Warren B. Earl, Secretary, Box 1027, Reno, Nev.

Connecticut Veterinary Medical Association. Hartford, Conn. February 1, 1933. Dr. Edwin Laitinen, Secretary, 993 N. Main St., West Hartford, Conn.

Alabama Veterinary Medical Association and Short Course for Graduate Veterinarians. College of Veterinary Medicine, Alabama Polytechnic Institute, Auburn, Ala. February 7-11, 1933. Dr. C. A. Cary, Dean, Alabama Polytechnic Institute, Auburn, Ala.

Illinois State Veterinary Medical Association. Saint Nicholas Hotel, Springfield, Ill. February 15-16, 1933. Dr. D. F. Luckey, Secretary, Hotel Silas, Springfield, Ill.

American Veterinary Medical Association. Palmer House, Chicago, Ill. August 14-18, 1933. Dr. H. Preston Hoskins, Secretary, 1230 W. Washington Blvd., Chicago, Ill.

TESTS OF THE EFFICACY OF SINGLE TREATMENTS WITH TRACHEAL BRUSHES IN THE MECHANICAL REMOVAL OF LUNGWORMS FROM FOXES*

By KARL B. HANSON, *Saratoga Springs, N. Y.*
Bureau of Biological Survey
U. S. Department of Agriculture

INTRODUCTION

Because of its marked prevalence and its effects upon animals, lungworm infestation is one of the most important troubles encountered in fox-farming. The worms are most prevalent where the climate is moist and the soil damp and heavy. Once on a ranch, these parasites invariably persist as a permanent menace and commonly become more troublesome each year.

Only two kinds of lungworms are found with noteworthy frequency in ranch-raised foxes in this country. These are *Eucoleus aerophilus* (Creplin, 1839) and *Crenosoma vulpis* (Creplin, 1847). The former is widely prevalent, but the latter is encountered on only a few ranches.

Heavy infestations in foxes may be attended with weakness, emaciation, unthrifty fur, failure to shed, and poor growth. Extremely heavy infestations usually result in death from bronchopneumonia. As a general rule, the disease is insidious and chronic. A rattling and wheezy respiration and spells of coughing are the preponderant symptoms.

For a few years after it was first realized that lungworms constituted a serious problem in fox-farming, various proprietary formulae for intratracheal injections were extensively foisted upon the industry. These usually were sold at exorbitant prices and with the claim that they were safe, effective cures. Time and experience soon demonstrated that these remedies are questionable. This is the same as has been the general experience in the use of various injections and fumigants advocated for the treatment of other animals for lungworms. Hall[1] has stated:

> As regards the treatment of lungworms in horses, there is no medical treatment which appears to be worth recommending at the present time. A large number of drugs have been recommended for intratracheal injections, fumigations, etc., but experience and critical tests have failed to establish the value of any of these, so far as the writer is aware. . . . The writer is quite in accord with Gilruth in regard to the superiority of the nursing treatment over medicinal treatment for lungworms.

*Presented at the sixty-ninth annual meeting of the American Veterinary Medical Association, Atlanta, Ga., August 23-26, 1932.

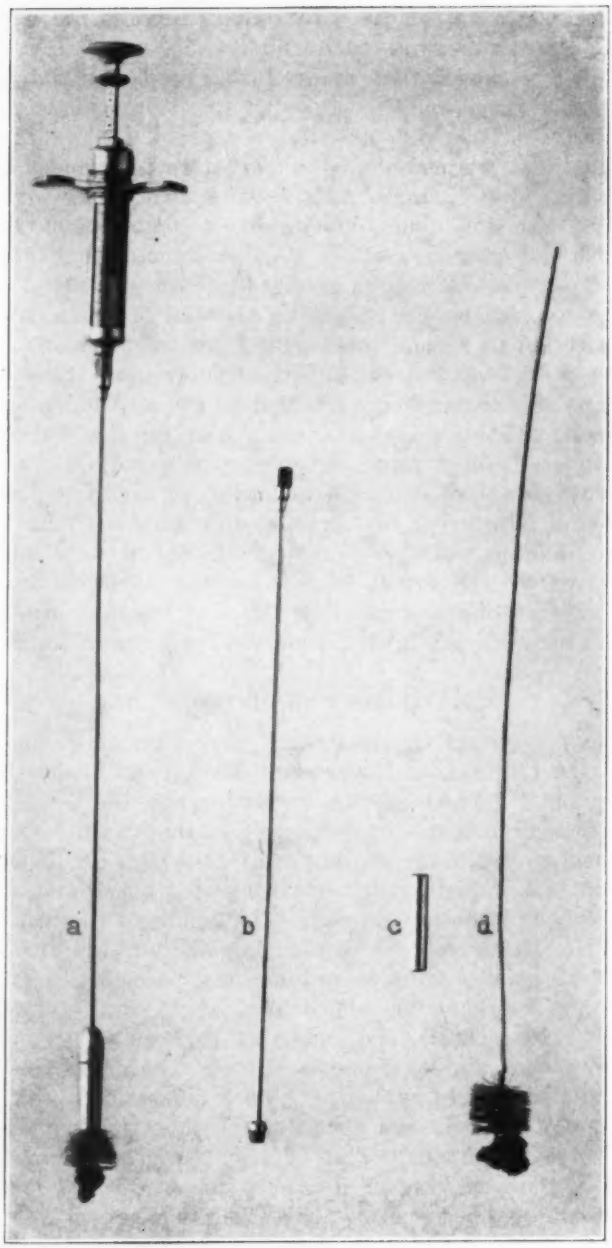

FIG. 1. Tracheal swab-syringe and parts: *a*, entire instrument assembled; *b*, nozzle; *c*, thimble; *d*, sponge-capped brush.

More or less in agreement with Hall as regards the value of the nursing and sanitation treatment, Hanson[2] reported that his experience has shown that many foxes subject to lungworm trouble can be saved and even cured if this treatment is applied soon enough.

In 1927, there was placed on the market an instrument known as a tracheal swab-syringe, for treating foxes infested with lungworms (fig. 1). This instrument, a combination tracheal swab-brush and tracheal syringe, is so constructed that insertion of the plunger results simultaneously in (1) a protrusion of the brush from a thimble-like guard on the end of the nozzle and (2) an ejection of a medicinal liquid from the syringe. If one desires to use the instrument as a tracheal syringe, the quantity of medicine injected can be controlled by the adjustable stop on the plunger. When this was first placed on the market the manufacturer claimed that the chief purpose of the sponge-tipped brush was to swab up excess mucus and facilitate bringing the medicine into direct contact with the worms. Since a few casual preliminary tests revealed that lungworms were ensnared and removed by the brush, it was deemed advisable to make critical tests of this and of other types of tracheal brushes to determine their efficacy in the mechanical removal of lungworms from foxes.

Materials and Methods

The tests reported in this paper were performed on foxes pelted at the Fur Animal Experiment Station and at one private ranch, during 1927 and subsequent pelting seasons.

Two types of instruments were used in these tests. One was the tracheal swab-syringe already mentioned (fig. 1). The other was a home-made instrument consisting of a brush and a short piece of rubber tubing (fig. 2, a). The handle of the brush was made of No. 18 copper wire twisted spirally, and the brush portion of black bristles from an ordinary flat paint-brush obtained at a five-and-ten-cent store. The total length of the brush and handle was 15 inches. The length of the bristle portion was 1½ to 2½ inches, and its diameter ⅝ inch. The tube (6½ inches long) was made of red rubber of $\frac{3}{16}$-inch lumen and $\frac{5}{16}$-inch outside diameter. The insertion end of the tube was rounded and tapered on a grindstone. Just before passage, the brush was inserted so that the ring at its end barely protruded from the insertion end of the tube (fig. 2, b). The tube served as a guide and guard for the brush until it was inserted an inch or so into the trachea.

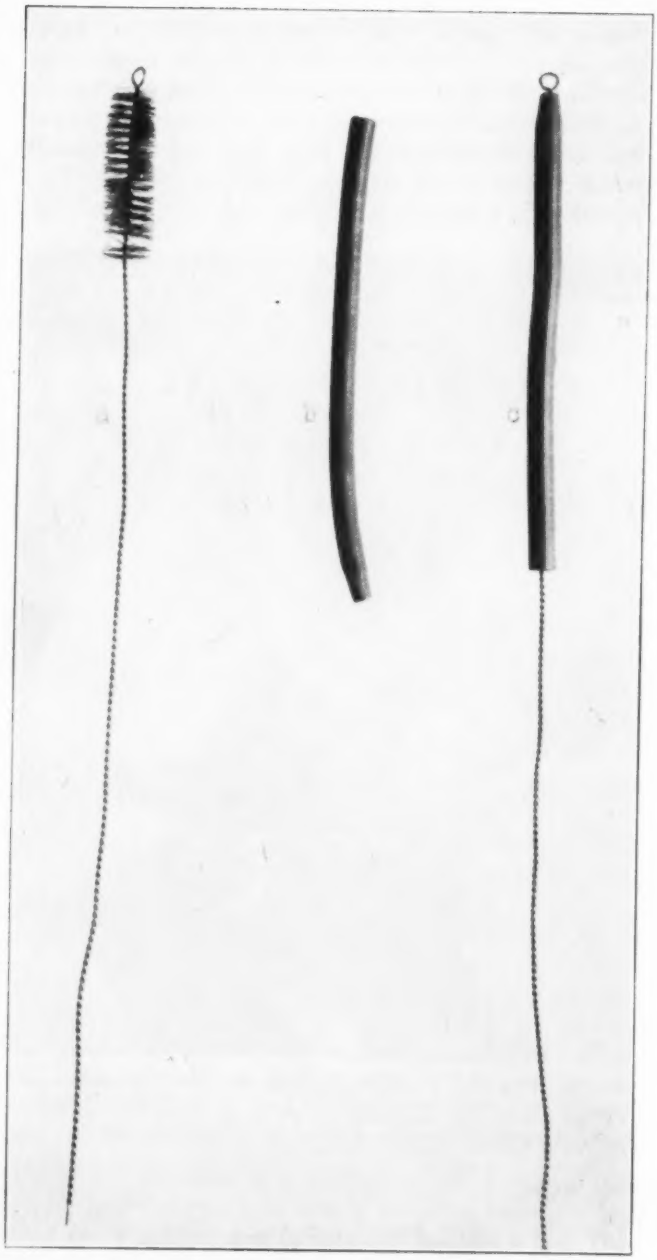

FIG. 2. Home-made tracheal brush and parts: *a*, brush; *b*, tube; *c*, tube with brush inserted.

The mode of restraint and method of passing the tracheal swab-syringe were as follows: One assistant, holding the front legs and tongs in the left hand and the hind legs in the right, laid the animal on its right side on an operating-table. This table was tilted upwards at the front end and so placed that the sun provided light in the mouth. A second assistant forced the mouth open with a speculum. Either the operator or the second

FIG. 3. The first assistant, holding the front legs and tongs in the left hand and the hind legs in the right, placed the fox on its right side on an operating-table. The second assistant applied a speculum and forced the mouth open.

assistant grasped the front legs and removed the tongs, while the first assistant obtained a new hold on the front legs close to the body and stretched the animal out tightly so as to prevent it from wriggling. Using a small piece of cloth to facilitate a secure grip, the operator grasped the tongue with the left hand

and pulled it out a reasonable distance. The operator passed the instrument back into the mouth with the right hand, gently inserted the nozzle into the laryngeal opening, and continued passing the instrument until the junction of the nozzle and syringe coincided with the incisor teeth. Upon reaching this point, the operator inserted the plunger of the syringe so as to protrude the brush from the thimble-like guard at the end of the nozzle. Then he slowly withdrew the instrument and let go of the tongue. Upon insertion of the nozzle an inch or so into the windpipe, the first assistant shifted the rear end of the fox toward him (fig. 4) so as to eliminate the natural curve in the trachea, which would interfere with passage of the instrument (fig. 5).

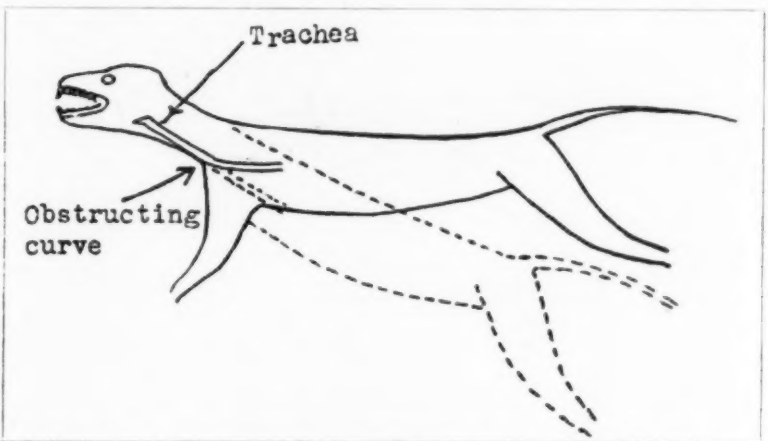

FIG. 4. When the operator had inserted the nozzle of the tracheal swab-syringe into the laryngeal opening, the first assistant pivoted the rear end of the fox toward him so as to straighten the trachea and facilitate passage of the instrument to the lower region of the trachea.

The mode of restraint, when the home-made tracheal brush was used, was the same as that just described, with the exception that the first assistant did not pull the rear end of the fox toward him to straighten the trachea. The home-made brush was sufficiently flexible to make this procedure unnecessary.

Before starting to pass the home-made tracheal brush, the operator measured the distance from the incisor teeth to the dorsal part of the eighth intercostal space from the rear, this distance in foxes indicating the distance from the incisor teeth to the bifurcation of the trachea. The handle of the brush was then bent at the proper distance from its insertion end (fig. 6)

and passage of the instrument was accomplished in the following manner:

The tongue was held with the left hand and the instrument passed with the right until the outer end of the tube was flush with the incisor teeth. The tube was not passed any farther, but was held at this point. Passage of the brush was continued slowly and gently, however, until the bend in the handle came against the outer end of the tube. Then as the instrument was withdrawn slowly, the brush was rotated slowly in a clockwise direction (fig. 7). The tongue was held with the left hand until the instrument was withdrawn completely.

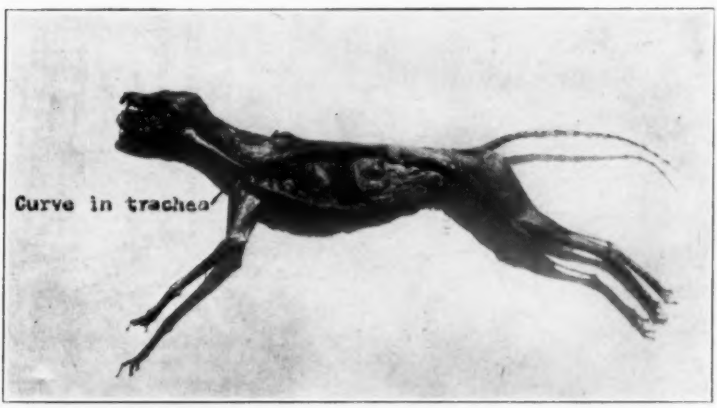

FIG. 5. The trachea describes an angle as it enters the thoracic cavity. Unless the trachea is straightened, this angle interferes with passage of the tracheal swab-syringe.

A separate, sterile brush was used for the treatment of each fox. The syringe, nozzle, rubber tubes, and other parts of the instruments likewise were cleaned and sterilized before being used. The operation was performed under conditions as aseptic as possible. When more than one animal was treated at a time, the parts of the instrument that were used on successive individuals, such as the syringe, thimble, and nozzle of the tracheal swab-syringe, were rinsed out and soaked in a disinfectant solution.

Promptly after the treatment, each brush was placed in a separate tube of water. As soon as convenient the worms were removed from the brushes, collected, identified and counted. A curved needle was used in picking the worms out of the brushes, which were held under water in a large crystallization dish.

Within 24 hours after treatment, the animals were killed by

one of the following methods: (1) an intracardial injection of chloroform; (2) stunning with a blow on the head, luxation of the atlanto-occipital articulation, insertion of a long sticking-knife in the mouth and cutting the blood-vessels on each side of the throat, and tying the animal up by the hind legs until it was dead and all bleeding had stopped; or (3) electrocution with 110- or 220-volt alternating current while under ether anesthesia.

The method pursued in preparing the different respiratory organs for the postmortem collection of worms was as follows: The larynx, trachea, lungs and heart were removed intact and the heart ablated. The blood was then thoroughly washed off.

FIG. 6. After measuring the distance from the incisor teeth to the dorsal part of the 8th intercostal space from the rear by means of a rod, the handle of the brush was bent at the point an equivalent distance from its insertion end.

The trachea was slit longitudinally along the middle of the cartilaginous rings and placed in a vessel of water. The bronchi and bronchioles were slit open by means of a small pair of avian postmortem scissors, an instrument well adapted for this purpose because the small ball-point on the end of one blade makes it easy to open even the smaller bronchioles. With the air passages

opened, the lungs were placed in a second vessel of water. That portion of the skull containing the nasal passages and chambers was removed by means of a pair of bone-shears. The various parts of the nasal chambers were opened with the same instrument and placed in other vessels of water.

The collection of the worms was done with the tissues immersed in water. Frequent rinsing and changes of water were made. None of this water was discarded, however, until after it

FIG. 7. As the tube was gently withdrawn, the brush was slowly rotated in a clockwise direction.

had been poured into a large crystallization dish and all the worms collected. Inasmuch as a large percentage of specimens of *E. aerophilus*, particularly small ones, tended to float rather than sink, the surface as well as the deeper portions of the water was examined. When water from a receptacle containing tissues being examined for lungworms was poured into the crystallization dish, care was taken to rotate the receptacle slowly to keep the worms from adhering to dry areas on the sides or edge. Worms of this species show a marked tendency to cling to dry surfaces.

For picking and collecting the worms, curved needles, camel's hair brushes, and small tweezers were used, after which the worms were identified and counted.

Location of Lungworms

Since the location of lungworms has an important bearing on the possibilities of treatment with either the tracheal swab-syringe or the tracheal brush, it was deemed advisable to make examinations of carcasses of foxes that had not been treated within a month of death, preferably those that had not been treated at all, to determine the percentage of worms located in the accessible zone, namely, the trachea. At first it was believed that it was necessary to take into consideration only the trachea, bronchi and bronchioles, and, for this reason, the extent of nasal infestation was not determined in the tests performed during the early stages of the work. After the work had been in progress for a considerable period, however, clinical observations made in connection with periodic treatments indicated that nasal infestation was more prevalent and significant than originally realized. Data of examinations to determine the location of lungworms are presented in tables I, II and III.

The location of *E. aerophilus* was found to vary considerably in

Table I—*Location of Eucoleus aerophilus (extent of nasal infestation not determined).*

Fox	Total Number Present	Location	
		Trachea	Lungs
884	1	1	0
880	4	3	1
882	5	1	4
886	5	1	4
881	6	3	3
883	8	2	6
878	13	5	8
889	13	11	2
877	17	9	8
879	17	10	7
C-80	22	15	7
937	22	22	0
998	29	14	15
995	30	15	15
887	31	26	5
997	55	32	23
971	112	69	43
970	602	228	374
Total	992	467	525
Per Cent		47.08	52.92

different foxes. On the whole, however, there were sufficient numbers located in the trachea to indicate that either of the two instruments might prove of considerable value in treatment. Whether this variability in distribution was due to a variation in stage or duration of infestation in the different foxes at the time killed is not known. This variation is a matter worth investigating. Findings being made in connection with the periodic treatment of foxes indicate that Eucoleus undoubtedly migrates from the bronchi and bronchioles to the trachea, and possibly from there to the nasal chambers.

C. vulpis was fairly consistent in its location. Most specimens were in the bronchi and bronchioles, more particularly the latter.

TABLE II—*Location of Crenosoma vulpis.**

Fox	Total Number Present	Location		
		Trachea	Bronchi and Bronchioles	Nasal Chambers
1023	1	0	1	0
1333	1	0	1	0
1345	1	0	1	0
1356	1	0	1	0
1365	1	0	1	0
1369	1	0	1	0
1526	1	0	1	0
C-77	2	1	1	?
C-775	2	0	2	?
903	2	0	2	?
1336	2	0	2	0
1386	2	0	1	1
981	3	0	3	?
B-49	3	1	2	?
1334	3	0	2	0
1533	3	0	3	0
982	4	1	3	?
C-76	5	0	5	?
C-75	6	0	6	?
904	6	0	6	?
1335	7	0	7	0
1348	7	0	7	0
1349	7	0	7	0
1346	12	0	12	0
C-8	20	0	20	?
1347	55	0	55	0
Total	157	3	153	1
Per Cent		1.91	97.45	0.64

*All of these animals except fox 1386 were used in critical tests of the two instruments under investigation. It was necessary to compile the data from this source because no other foxes infested with *Crenosoma vulpis* were available.

Only a few were in the trachea, and still fewer in the nasal chambers. The fact that only a small percentage was present in the trachea indicates that neither of the two instruments could be expected to show an appreciable efficacy against this parasite.

The findings reported in table III indicate that infestation of the nasal chambers with Eucoleus is widely prevalent and of significance. The data in this table show that the proportion of Eucoleus present in the trachea of these foxes was considerably lower than in those reported in table I. Tracheal infestation comprised 25.28 per cent in the former and 47.08 per cent in the latter. This variation undoubtedly was due partly to the fact that nasal infestation, which amounted to 11.42 per cent, was taken into account in the later cases and not in the earlier. There is the possibility, however, that the difference was due also partly to the fact that a considerable number of the animals reported in table III had been treated with either a tracheal swab-syringe or a tracheal brush a month or more before postmortem, whereas none of the foxes reported in table I had been treated before.

Efficiency Tests on Dead Foxes

There was need to study modes of restraint and technic before undertaking the treatment of live foxes; consequently, prelimi-

Table III—*Location of Eucoleus aerophilus and Crenosoma vulpis.*

Fox	Total Number Present		Location					
			Trachea		Bronchi and Bronchioles		Nasal Chambers	
	Euco.	Cren.	Euco.	Cren.	Euco.	Cren.	Euco.	Cren.
1147*	2	0	0	0	2	0	0	0
1372*	4	0	1	0	0	0	3	0
1373*	7	0	2	0	4	0	1	0
1141*	14	0	2	0	1	0	11	0
1023*	16	1	9	0	1	1	6	0
1345*	22	0	1	0	17	0	4	0
1346*	22	12	9	0	12	12	1	0
1369*	24	1	0	0	11	1	13	0
1365*	68	1	1	0	7	1	60	0
1136	73	0	31	0	42	0	0	0
1386	163	2	72	0	69	1	22	1
1314	645	0	140	0	505	0	0	0
Total	1060	17	268	0	671	16	121	1
Per Cent			25.28	0	63.30	94.12	11.42	5.88

*Although they had not been treated within 6 weeks or more before postmortem examination, these animals had been treated at periodic intervals prior thereto, either no lungworms or only a very small number having been removed.

nary tests were performed first on freshly killed animals. It was considered that such tests would give a fair idea of the efficiency to be expected in actual treatments and that they would afford an opportunity to study and work out certain problems of technic.

These tests (see tables IV and V) showed that both instruments were relatively effective in removing worms present in the trachea. The indications, then, are that either instrument is fairly effective against Eucoleus but relatively ineffective against Crenosoma, because a low percentage of the latter is in an accessible zone—the trachea.

Of the 12 dead foxes on which the tracheal swab-syringe was passed, 11 were infested with Eucoleus and 2 with Crenosoma. There was a total of 140 Eucoleus present in the trachea, bronchi and bronchioles. Of these, 105 were situated in the trachea. The instrument removed 74, an efficacy of 52.86 per cent against the entire infestation and 70.48 per cent against the tracheal. No Crenosoma were removed, because all of these were located in the bronchi and bronchioles.

TABLE IV—*Critical tests of tracheal swab-syringe on dead foxes (extent of nasal infestation not determined).*

Fox	Total Number Present		Number Removed by Instrument		Number Retained					
					Total		Trachea		Lungs	
	Euco.	Cren.	Euco.	Cren.	Euco.	Cren.	Euco.	Cren.	Euco.	Cren.
899	2	0	0	0	2	0	0	0	2	0
900	3	0	3	0	0	0	0	0	0	0
898	4	0	1	0	3	0	2	0	1	0
895	6	0	3	0	3	0	1	0	2	0
901	7	0	5	0	2	0	0	0	2	0
902	8	0	6	0	2	0	0	0	2	0
894	10	0	8	0	2	0	0	0	2	0
903	13	2	10	0	3	2	2	0	1	2
905	14	0	10	0	4	0	0	0	4	0
897	21	0	9	0	12	0	1	0	11	0
893	52	0	19	0	33	0	25*	0	8	0
904	0	6	0	0	0	6	0	0	0	6
Total	140	8	74	0	66	8	31	0	35	8
Total infestation (%)			52.86	0	47.14	100	22.14	0	25.00	100
Tracheal infestation (%)			70.48	—						

*All located in the lower inch or so of the trachea. This was a long, rangy fox, and the indications are that the instrument failed to reach this region.

All of the 13 dead foxes on which the tracheal brush was passed were infested with Eucoleus and 6 with Crenosoma also. In the trachea, bronchi and bronchioles, 452 Eucoleus were present, and 340 of these were located in the trachea. The instrument removed 272, an efficacy of 60.18 per cent against the entire infestation and 80 per cent against the tracheal. There was a total of 38 Crenosoma present. The instrument removed the only 2 specimens located in the trachea, an efficacy of 5.26 per cent against the entire infestation and 100 per cent against the tracheal.

The large number of Eucoleus left in the lower 2 inches of the trachea of fox 893 indicates that the tracheal swab-syringe does not reach to the bottom of the trachea in long, rangy foxes when the instrument is uniformly passed on all animals so that the junction of the nozzle and syringe coincides with the incisor teeth. There appears to be no safe or practical method of gaug-

TABLE V—*Tests of tracheal brush on dead foxes (extent of nasal infestation not determined).**

Fox	Total Number Present		Number Removed by Instrument		Number Retained					
					Total		Trachea		Lungs	
	Euco.	Cren.	Euco.	Cren.	Euco.	Cren.	Euco.	Cren.	Euco.	Cren.
C-775	5	2	5	0	0	2	0	0	0	2
C-163	6	0	6	0	0	0	0	0	0	0
C-161	7	0	7	0	0	0	0	0	0	0
C-142	15	0	6	0	9	0	9	0	0	0
C-126	17	0	16	0	1	0	1	0	0	0
C- 77	19	2	15	1	4	1	0	0	4	1
C- 93	21	0	13	0	8	0	8	0	0	0
C- 8	24	20	12	0	12	20	3	0	9	20
C- 78	29	0	13	0	16	0	12	0	4	0
C- 81	35	0	27	0	8	0	4	0	4	0
C- 75	49	6	42	0	7	6	3	0	4	6
B- 49	57	3	38	1	19	2	7	0	12	2
C- 76	168	5	72	0	96	5	21	0	75	5
Total	452	38	272	2	180	36	68	0	112	36
Total infestation (%)			60.18	5.26	39.82	94.74	15.04	0	24.78	94.74
Tracheal infestation (%)			80	100						

*The brush was passed on these animals a few minutes after they were killed.

Note: All of these tests were performed on a private ranch. Since there were not facilities there for collecting and identifying the worms postmortem, the larynx, trachea and lungs were placed intact in a jar of 2 per cent formaldehyde solution and examined a week or so later. It is possible that some of the worms originally located in the bronchi and adjacent bronchioles.

ing the proper depth of insertion when the distance to the bifurcation of the trachea exceeds by an inch or more the distance taken as the standard in the construction of this instrument. In the animal in question, the distance to the bifurcation of the trachea was 13¾ inches. The distance from the junction of the nozzle and syringe to the end of the brush, protruded to its utmost limit, is 11½ inches.

Efficiency Tests on Live Foxes

Data of critical tests of single treatments of live foxes with the tracheal swab-syringe and tracheal brush are presented in tables VI, VII and VIII. The tests reported in tables VI and VII were performed before the determination of the degree of nasal infestation was made a regular practice in the postmortem examinations. Table IX is a compilation of tests of the two instruments on both dead and live foxes. This compilation was made because of the paucity of data on tests of foxes infested with Crenosoma.

The retention of specimens of Eucoleus in the lower 2 inches of the trachea of fox 908 (table VI) was another case of the tracheal swab-syringe failing to reach the bottom of the trachea

Table VI—*Critical tests of tracheal swab-syringe on live foxes (extent of nasal infestation not determined).**

Fox	Eucoleus aerophilus				
	Total number present	Number removed by instrument	Number retained		
			Total	Trachea	Bronchi and bronchioles
872	1	0	1	0	1
909	1	1	0	0	0
907	6	3	3	0	3
910	14	11	3	0	3
906	15	9	6	1	5
875	19	7	12	0	12
865	39	21	18	2	16
874	48	15	33	0	33
908	159	49	110	21†	89
Total	302	116	186	24	162
Total infestation (%)		38.41	61.59	7.95	53.64
Tracheal infestation (%)		82.86			

*None of these foxes were infested with *Crenosoma vulpis*.
†Most of these worms were located in the lower 2 inches of the trachea. This was a long, rangy fox in which the brush portion of the instrument failed to reach the bottom of the trachea by about 2 inches.

in a long, rangy animal. The distance to the bifurcation of the trachea in this animal was 13½ inches.

All the foxes treated with the tracheal swab-syringe were infested with Eucoleus (table VI). Of the 302 Eucoleus present in the trachea, bronchi and bronchioles, 140 were located in the trachea. The instrument removed 116, an efficacy of 38.41 per cent against the entire infestation and 82.86 per cent against the tracheal.

Of the 14 foxes treated with the tracheal brush and reported on in table VII, all were infested with Eucoleus, and 2 with Crenosoma. Of 177 Eucoleus in the trachea, bronchi and bronchioles, 108 were located in the trachea. The instrument removed 95, an efficacy of 53.67 per cent against the entire infestation and 87.96 per cent against the tracheal. Of the 7 Crenosoma present, one was located in the trachea. No Crenosoma were removed by treatment.

A large proportion of the foxes used in the tests of the tracheal brush reported in table VIII, although not treated within a month or so of the tests reported, had previously been treated at periodic intervals. Whether the earlier treatments had an

TABLE VII—*Tests of tracheal brush on live foxes (extent of nasal infestation not determined).*

Fox	Total Number Present		Number Removed by Instrument		Number Retained					
					Total		Trachea		Lungs	
	Euco.	Cren.	Euco.	Cren.	Euco.	Cren.	Euco.	Cren.	Euco.	Cren.
C-30	3	0	3	0	0	0	0	0	0	0
989	4	0	2	0	2	0	0	0	2	0
986	5	0	3	0	2	0	0	0	2	0
985	7	0	7	0	0	0	0	0	0	0
990	7	0	7	0	0	0	0	0	0	0
C-32	8	0	6	0	2	0	2	0	0	0
983	10	0	1	0	9	0	0	0	9	0
984	12	0	8	0	4	0	2	0	2	0
978	14	0	10	0	4	0	0	0	4	0
981	14	3	8	0	6	3	0	0	6	3
988	17	0	14	0	3	0	0	0	3	0
980	18	0	9	0	9	0	6	0	3	0
982	23	4	6	0	17	4	1	1	16	3
987	35	0	11	0	24	0	2	0	22	0
Total	177	7	95	0	82	7	13	1	69	6
Total infestation (%)			53.67	0	46.33	100	7.34	14.29	38.98	85.71
Tracheal infestation (%)			87.96	0						

TABLE VIII—*Tests of tracheal brush on live foxes (extent of nasal infestation determined).*

Fox	Total Number Present		Number Removed by Instrument		Number Retained							
					Total		Trachea		Lungs		Nasal Chambers	
	Euco.	Cren.	Euco.	Cren.	Euco.	Cren.	Euco.	Cren.	Euco.	Cren.	Euco.	Cren.
1510*	1	0	0	0	1	0	0	0	0	0	1	0
1149*	3	0	1	0	2	0	0	0	2	0	0	0
1138*	6	0	3	0	3	0	1	0	2	0	0	0
1504*	8	0	2	0	6	0	0	0	0	0	6	0
1524	9	0	7	0	2	0	0	0	0	0	2	0
1533	12	3	8	0	4	3	0	0	2	3	2	0
1133*	14	0	2	0	12	0	0	0	12	0	0	0
1506*	18	0	1	0	17	0	0	0	11	0	6	0
1332*	20	0	6	0	14	0	0	0	11	0	3	0
1348*	35	7	20	0	15	7	0	0	12	7	3	0
1340*	50	0	11	0	39	0	1	0	36	0	2	0
1352*	58	0	9	0	49	0	1	0	39	0	9	0
1364*	67	0	19	0	48	0	1	0	33	0	14	0
1526	67	1	15	0	52	1	0	0	34	1	18	0
1334*	103	3	26	0	77	3	0	0	72	3	5	0
1349*	131	7	48	0	83	7	5	0	53	7	25	0
Total	602	21	178	0	424	21	9	0	319	21	96	0
Total infestation (%)			29.57	0	70.43	100	1.50	0	52.99	100	15.95	0
Tracheal infestation (%)			95.19	—								

*Although not treated within 4 weeks of the last treatment just before death, these particular animals had been treated at periodic intervals prior thereto. Almost without exception, only a few or no worms were removed by the treatments within 4 to 8 weeks of the final treatment.

appreciable effect upon the results encountered in these tests is problematical. All 16 of the animals used in these tests were infested with Eucoleus and 5 with Crenosoma. Of the 602 Eucoleus present, 187 (31.06 per cent) were in the trachea, 319 (52.99 per cent) in the bronchi and bronchioles, and 96 (15.95 per cent) in the nasal chambers. The instrument removed 178, an efficacy of 29.57 per cent against the entire infestation and 95.19 per cent against the tracheal. Of the 21 Crenosoma present, all were located in the bronchi and bronchioles. The instrument removed no specimens of Crenosoma.

Both instruments showed a higher efficacy against tracheal

TABLE IX—*Tests of tracheal swab-syringe and tracheal brush against Crenosoma vulpis.*

Fox	Total Number Present	Number Removed by Instrument	Number Retained			
			Total	Location		
				Trachea	Bronchi and Bronchioles	Nasal Chambers
1023	1	0	1	0	1	?
1333	1	0	1	0	1	0
1345	1	0	1	0	1	0
1356	1	0	1	0	1	0
1365	1	0	1	0	1	0
1369	1	0	1	0	1	0
C-77*	2	1	1	0	1	?
C-775*	2	0	2	0	2	?
903*†	2	0	2	0	2	?
1336	2	0	2	0	2	0
B-49*	3	1	2	0	2	?
981	3	0	3	0	3	?
982	4	0	4	1	3	?
C-76*	5	0	5	0	5	?
C-75*	6	0	6	0	6	?
904*†	6	0	6	0	6	?
1335	7	0	7	0	7	0
1348	7	0	7	0	7	0
1349	7	0	7	0	7	0
1346	12	0	12	0	12	0
C-8*	20	0	20	0	20	?
1347	55	0	55	0	55	0
Total	149	2	147	1	146	0
Total infestation (%)	1.34		98.66	0.67	97.99	0
Tracheal infestation (%)	66.67		–			

*The instrument was passed on these animals a few minutes after death.
†The tracheal swab-syringe was used on these animals and the tracheal brush on all others.

infestation with Eucoleus in the tests on the live foxes than in those on the dead animals. Although this difference possibly may have been partly a matter of chance in sampling, it is also possible that it is partly due to improvement in technic in the passage of the instruments. Most of the tests on the dead foxes were performed before those on the live animals. It is believed that the high efficacy of 95.19 per cent against tracheal infestation with Eucoleus in the tests reported in table VIII is due not only to better technic of treatment but also partly to improvements in certain details of construction of the tracheal brush.

Of 63 foxes infested with Eucoleus upon which either the tracheal swab-syringe or tracheal brush was passed, the instrument removed specimens from all but three. The three infested foxes (872, 899 and 1510), from which no specimens of Eucoleus were removed by the instrument, carried very light infestations. There was also a strong positive correlation between the number of Eucoleus removed by the instrument and the total number present in the animals. Of 22 foxes infested with Crenosoma upon which one or the other of the two instruments was passed, treatment resulted in the removal of specimens from only two. There was no correlation between the number of Crenosoma removed by the instrument and the total number present in the animals. These findings indicate that both the tracheal swab-syringe and the tracheal brush are of considerable value in the diagnosis of Eucoleus infestation but negligible for Crenosoma.

The tests reported in table IX indicate that neither of the two instruments is of value in treating foxes infested with Crenosoma. This is chiefly because of the apparent tendency for most specimens of this parasite to be located in the bronchi and bronchioles. There were 149 Crenosoma in the 22 foxes upon which one or the other of the two instruments was passed. Of these, 3 were in the trachea and 146 in the bronchi and bronchioles. Only 2 Crenosoma were removed, an efficacy of 1.34 per cent against the entire infestation and 66.67 per cent against the tracheal.

None of the foxes used in these tests showed any ill effects as a result of the treatment. In a few cases in which the animals were killed within a few minutes after treatment, a slight hyperemia of the mucosa of the larynx was observed. This possibly was transitory, because it was not apparent in any of the foxes killed several hours or the next day after treatment. The treatment proved to be considerably less severe than originally had

been anticipated. Several animals ate a hearty meal within a half-hour after treatment.

SUMMARY

Studies were made to determine the location of two species of lungworms of foxes, namely *Eucoleus aerophilus* and *Crenosoma vulpis*.

In critical tests made to determine the efficacy of two types of tracheal brushes in the treatment of foxes for lungworms, the home-made type showed a slightly higher efficacy than the tracheal swab-syringe. This was largely due to the fact that the swab-syringe failed to reach to the bottom of the trachea in long, rangy foxes.

Both instruments showed a relatively high efficacy in removing worms located in the trachea. The average efficacies against tracheal infestation in the arbitrary groups, in percentages, were 70.48, 80, 82.86, 87.96 and 95.19, respectively, for Eucoleus; and 100, 0 and 66.67, respectively, for Crenosoma.

The efficacy against the entire Eucoleus infestation varied considerably with individual foxes. This was chiefly due to variation in the extent of the tracheal infestations. The efficacy was sufficiently high in a large number of the foxes to indicate that the tracheal brush treatment gives promise of being of noteworthy value. The average efficacies against the entire Eucoleus infestation in the arbitrary groups, in percentages, were 52.86, 60.18, 38.41, 53.67 and 29.57.

The two instruments were of negligible efficacy in removing Crenosoma, because most specimens of this parasite were located in the bronchi and bronchioles.

Both instruments give promise of being of value in the diagnosis of Eucoleus infestation in foxes but negligible for Crenosoma.

The tracheal brush treatment appears to be relatively safe and harmless when performed with proper care and judgment.

A mode of restraint and a method of passing each of the two instruments studied are described.

REFERENCES

[1]Hall, M. C.: Lungworms of domestic animals. Corn. Vet., xii (1922), 2, pp. 131-157.

[2]Hanson, K. B.: Lungworms in foxes and their treatment. Amer. Fox & Fur Breeder, iv (1925), 9, pp. 5-6.

DISCUSSION

DR. J. E. SHILLINGER: I might add that the safety of the tracheal brush is very evident, since on one ranch with which I have been acquainted the superintendent made a practice of using the tracheal

brush every other day, to get the worms as fast as they came up from the lung tissue into the trachea. There were no apparent bad results from using the tracheal brush every other day in this instance. It must be relatively safe or they would have had some trouble with such frequent use. It is apparent that it can be used very satisfactorily in controlling the infestation and preventing a repetition of infestation. One of the difficult situations of lungworm infestation is the fact that eggs of lungworms are viable for over a year. This makes it very difficult for the rancher to place the animals on clean ground, since the fox pens are put down at considerable expense, being usually of a very durable type of construction, and it is almost impossible to remove them satisfactorily. It is almost as cheap to build new pens.

DR. E. J. FRICK: Do you know anything about the life history of the lungworm in foxes?

DR. SHILLINGER: That has not been definitely worked out, but indications are that it is the same in both species. Investigators have not been able to find any evidence that any insect or other form of life is necessarily a factor.

DR. FRICK: It seems to be well established that foxes in high altitudes, as in the Rocky Mountain region, do not have lungworms. Can you offer any solution?

DR. SHILLINGER: Only if we assume that, perhaps, the climatic and atmospheric conditions and the dry soil have a tendency to reduce the infection. We find that in general these infestations are more severe when the foxes are kept in pens that are more or less shaded and inclined to be damp. I was conservative when I said eggs remained in the soil for as long as one year. They are sometimes reported remaining viable for two years. It is true, as you say, in the Rocky Mountain region, where there is high altitude and dry climate, that lungworms are not prevalent, and fox-ranchers do not seem to be interested in the situation out there at all, but on the western slope they are bothered with them.

DR. FRICK: Flaming kennels would be the most suitable means of combating it from a financial standpoint, or would you use Chandler's iodin?

DR. SHILLINGER: None of the chemical agents that I have seen tried seem to be worth very much in the control of lungworm infestation. In fox ranches the expense of some of these chemical products precludes their proper use. No doubt they would be satisfactory if they were applied to the soil in sufficient quantities, but some of those products become inert as soon as they come in contact with organic matter. It would take immense quantities of the others to saturate the pens. I do not know how popular the torch is in dog-kennels, but on fox ranches there are thousands of those instruments that have been bought by fox-ranchers and discarded. They find that, in getting the torch to direct the heat into the soil, they have to hold it for an unreasonable length of time, since the soil appears to be a good insulator and the heat has a tendency to rise instead of going down. Our experience in using the torch makes us feel that it is of very little consequence. Together with that, it is almost impossible to use it as it should be used, around the edges of pens and against the wire, without burning off the wire. It does not take many moments, holding the flame against the wire, to burn it through. At any rate, heat will destroy the galvanizing and then the wire will rust.

DR. FRICK: Is spraying the pens of any value?

DR. SHILLINGER: It probably would have some value, but those who have practiced it find that they still have the same trouble, and what actual value it has I could not say. We have not run comparative tests on sprayed and non-sprayed pens. I know of some who have given

up old pens and built entirely new ranches to get away from the trouble. Many of them keep a few so-called hospital pens, specially constructed, with wire floors, about eight by twelve or eight by sixteen, that will enable the foxes to have a little exercise. They are so constructed that all of the fecal matter will fall through.

DR. C. W. BOWER: How about concrete floors?

DR. SHILLINGER: There are a few ranchmen who have built concrete floors, but the cost of construction almost precludes their use, and for some reason foxes appear not to do so well on a concrete floor. I do not know that we have any definite answer for it. Some have constructed a portion of their ranches with wooden-slat floors, so that the manure will fall through. This does seem to control lungworm and other parasitic infestations comparatively satisfactorily.

DR. C. F. SCHLOTTHAUER: Has anyone ever used the method of steaming the beds?

DR. SHILLINGER: Some are trying that out now. Of what value it is going to prove I do not know, because we have not had any reports following up these treatments. I am afraid it is going to be just the same as the torch method was a few years ago. All you had to do was to approach a fox-rancher with a blow-torch and let him see the flame, and he would decide that it was just the thing for disinfecting the soil. Now, practically all torches have been discarded on fox ranches.

Visit World's Fair for $80

The cost of one week in Chicago during the World's Fair in 1933 has been set at $80, in a recently-completed study made by the Chicago Association of Commerce. This includes round-trip rail and Pullman fares, hotel accommodations, meals, sightseeing, admission to the Fair, and amusements which include the theatre, a lake trip and a baseball game.

The total has been set at $80 so as to include all persons living within 700 miles of Chicago (which means 60 per cent of the population of the U. S.), but the report points out that many who live nearer, or who may drive to the city, will save proportionately. Prices allowed for hotel accommodations are $4 per day, with an additional $2 per day for meals. A total of $38.45 has been allotted for transportation; $30.95 for rail fare, and $7.50 for Pullman.

It is reported that local banks in various cities throughout the U. S. have started special savings clubs for World Fair trips.

Century of Progress Live Stock and Meat Exhibits

The live stock and meat exhibits at the 1933 "Century of Progress" world fair at Chicago will occupy the entire center wing of the agricultural building. An extensive exhibit of historical character is planned, which will depict the combined accomplishments of the live stock producer, the packer and the retailer during the last hundred years.

THE PRACTICING VETERINARIAN AND HIS RELATIONSHIP TO THE ARMY*

By LT. COL. D. S. TAMBLYN, *Kingston, Ontario*
Administering Officer, Canadian Army Veterinary Service

Like all other branches of an army, the veterinary services must necessarily be prepared in peace for war. To permit this, the policy and responsibilities of such a service should be definitely laid down; otherwise nothing but chaos can be expected in the event of war.

"Be prepared" is therefore the slogan of any nation in respect to the different services of its army in peace. This is particularly applicable to the medical and veterinary services; their work is allied in many respects and their very existence is dependent upon an efficient personnel and modern equipment.

The most essential point to remember in adapting the policy of the Army Veterinary Corps is:

The formation of an efficient administrative staff—a staff capable of conveying to others an appreciation of the difficulties which are encountered in army work, *e.g.*,

(1) The interpretation of regulations.

(2) The importance of their work as veterinarians within the Army, particularly in so far as it relates to the practice of preventive medicine, especially in regard to the introduction into one's own country, following a war, of some contagious or infectious disease through lack of preventive measures.

(3) The pleasure there is in being permitted to serve one's country in times of need.

(4) The social attainment from a professional point of view.

(5) The stimulus in the line of sports.

(6) The respect of seniors and to conduct oneself as an officer and gentleman at all times.

To prosecute these ideals coöperation is necessary. Permanent-force officers must coöperate with the non-permanent and vice versa. The Army Veterinary Corps is absolutely dependent upon the non-permanent officer (private practitioner). His interest is essential to the efficiency and success of the Corps generally. The fact of accepting a commission within the Corps is not sufficient. He must endeavor to improve his knowledge professionally and of the regulations laid down, particularly of those appertaining to his own Corps. He should attend all an-

*Presented at the sixty-ninth annual meeting of the American Veterinary Medical Association, Atlanta, Ga., August 23-26, 1932.

nual camps of instruction within the district in which he is serving and enter into the spirit of both work and sport. He must not be content simply to attend these camps, but should be original in his work, and serious, particularly in recording "case reports," and "descriptive rolls," and the completion of his work in connection with horse claims, prior to and after closing of camps.

Where hospitals or mobile veterinary sections are brought into use at camps of this nature, regimental veterinary officers and officers commanding veterinary hospitals and mobile veterinary sections should follow the same procedure in evacuating animals as in war. It is excellent training. Special attention should be given to diagnostic work, treatment and transportation of sick and injured animals. The use of a special descriptive label attached to the head collar of each animal: white for medical cases, green for surgical and red for mange or other communicable diseases, should be brought into use, so that in the event of the veterinary services being called upon to take the field, the officers and other personnel would be trained and prepared for such an emergency. No matter what duty an officer may be called upon to perform, it should be done in great detail.

Causes of wastage of animals in war can be minimized greatly by preventive measures. Incapacity, the result of hard work and insufficient food, together with a long list of diseases of a communicable or specific nature, usually go to form the veterinary wastage of war. Of these the following are worthy of close study:

Debility and exhaustion.
Mange.
Glanders.
Epizoötic lymphangitis.
Ulcerative cellulitis.
Ophthalmia (specific or periodic).
Influenza.
Strangles.
Pneumonia of the influenza type in all.
Dietetic diseases.
Accidental injuries.
Battle casualties.
Foot-and-mouth disease.
South African horse sickness, etc., etc.

Control of infectious and contagious diseases and, above all, preventive medicine, are of the utmost importance. The study

of management of the horse in the field, and of stable management is of great importance. The question of farriery (horseshoeing) must receive very close attention, particularly in the field, as well as the concentration of forges and farriery personnel, the shoeing of horses and mules short at the heel when traversing fascine roads to prevent pulling of shoes, and so forth.

It is pointed out that for an officer of any army veterinary corps to attain any marked degree of success, he has to be interested not only in professional matters but also in the service as a whole. It is surprising the appreciation shown by officers commanding when they observe their veterinary officers taking a keen interest in the unit to which they may be attached.

Non-permanent officers should not miss the opportunity of attending mess functions. It brings them into contact with persons whom they would not otherwise meet and incidentally, if they are in practice, it widens that practice very considerably.

The social status of veterinary officers is equal to that of all other officers. Therefore, it is essential that they should lose no opportunity to call upon the District Officer Commanding and his staff. Such brings about a better understanding and ofttimes matters can be discussed to the advantage of the service generally. The veterinary service can be made a very valuable asset to any army, but it behooves the members of the profession, and particularly the non-permanent officers, to make it so.

There are many fields of work which will eventually come under the jurisdiction of the veterinary service by virtue of its specially trained officers and the right of a profession, *e.g.*, food inspection, remounts, and others.

To me, complete mechanization of any army is not possible if efficiency and economy are to be maintained, for obvious reasons; and not until war is made impossible will the horse be replaced in war.

Organization

The Army Veterinary Service of the Canadian Militia consists of two branches:

(a) The R. C. A. V. C. Permanent.
(b) The C. A. V. C. Non-permanent.
(c) A reserve list of officers who are non-active.

The Royal Canadian Army Veterinary Corps: This branch consists of veterinary officers gazetted to the Corps, warrant officers, non-commissioned officers and men enlisted therein. The

names of the officers so gazetted are arranged on a regimental list of officers of the Corps, in order of seniority.

Detachments: R. C. A. V. C. officers, warrant officers, non-commissioned officers and men of the R. C. A. V. C. are posted by the officer administering the C. A. V. services to form detachments for duty as required in military districts.

The Canadian Army Veterinary Corps: This branch consists of veterinary officers gazetted to the C. A. V. Corps, and their names are arranged on a regimental list of officers of the C. A. V. C. They are detailed for duty with mounted units of the active militia as required, for a period not exceeding five years, when, if it is considered advisable in the interest of the Service, this term may be extended.

The number of the personnel of both the R. C. A. V. C. and the C. A. V. C. is laid down in the establishment annually approved by the Governor-in-Council.

Rank and precedence: Officers of the R. C. A. V. C. and C. A. V. C., by virtue of their rank, are entitled to precedence and other advantages attached to corresponding rank of combatant officers, but such rank or position does not entitle the holder of it to the presidency of courts martial; nor do they exercise any military command, outside the R. C. A. V. C. or C. A. V. C., except over such officers or soldiers as may be attached thereto for duty or who may be definitely placed under their command.

Administration and command: The Quartermaster-General of the Canadian Militia is the responsible head of the Canadian Army Veterinary Services. The senior officer of the R. C. A. V. C. is the officer administering the Canadian Army Veterinary Services. All recommendations for appointments and promotions are made by him, and he is also charged with the supervision of veterinary duties, supply of veterinary stores, preparation of statistical returns and estimates for the above service.

District veterinary officers: District veterinary officers of a military district are appointed from the regimental list of the R. C. A. V. C. or C. A. V. C.

Duties of district veterinary officers: (a) Any officer holding the appointment of District Veterinary Officer is responsible to the District Officer commanding the district in which he is serving, for the administration of the veterinary services, and commands the R. C. A. V. C. and C. A. V. C. within his district. (b) Veterinary stores in military districts are under charge of the D. V. O., he being Accounting Officer in that respect.

General duties: The officer administering the Canadian Army Veterinary Services nominates officers for the following ap-

pointments: (a) District Veterinary Officer, military districts. (b) The charge, and in some cases, the staff of veterinary hospitals. (c) The staff of Canadian Army veterinary schools, and other veterinary instructional appointments. (d) Veterinary staff of remount establishments. He also details veterinary officers, non-commissioned officers and men of the C. A. V. C. for duty under district veterinary officers. He keeps a roster of officers. For special appointments the widest discretion is vested in him to select the officers he considers best qualified.

Officers of the R. C. A. V. C.: These officers are charged with the care of sick animals, the administration of veterinary hospitals, and reporting to district officers commanding, or other commanding officers, verbally or in writing, on all matters relating to animals, stables, camps, transports, forage, stable management, forges and shoeing, and recommending any measures which may, in their opinion, conduce to the health and efficiency of the animals in their charge.

District veterinary officers: Under the District Officer commanding the military district, the D. V. O. has command of all officers, warrant officers, non-commissioned officers and men of the R. C. A. V. C. and C. A. V. C., as well as control of civil veterinary surgeons employed in the command. He countersigns and is responsible for the correctness of all documents passing through his office. Once a year he inspects all the horses and stables of permanent units in the command and, apart from these inspections, he may at any time visit stations or units if he considers it desirable (giving the officer commanding such units due notice of the date and time of his intended visit). A district veterinary officer, if there is no other veterinary officer, assumes the duties of Executive Veterinary Officer in addition to his other duties as D. V. O. District veterinary officers at all times report to the officer administering, C. A. V. Services, on matters with which they consider it advisable that officer should be made acquainted and, in referring such questions as may be necessary, record their opinions thereon. District veterinary officers submit the following reports to the District Officer Commanding, for his information:

(a) An annual general report and statistical return.
(b) Inspection report.
(c) Report on mobilization stores and equipment.

Additional duties during periods of training: District veterinary officers deal with all veterinary services, including the inspection of all horses taken on the strength of camps. Horses

found unfit are stricken off the strength of the camp and dealt with as laid down in pay and allowance regulations.

District veterinary officers are responsible for:

(a) A certified copy of the descriptive roll of horses of each mounted unit being furnished within three days after arrival in camp. Such rolls should contain a detailed description of the animal and note any physical defect of such, together with the names and addresses of both rider and owner. This is important. The onus in the preparation rests with the unit veterinary officer.

(b) Veterinary field chests properly filled are forwarded to the officer commanding the unit, through the Ordnance Depot of the district, in ample time for such to reach the headquarters of units before they leave for camps. Officers commanding units are held responsible for same and, at the end of the camp, for returning same with ordnance stores to the District Ordnance Officer of their respective districts. Should veterinary field chests not have been provided, requisitions for necessary veterinary supplies are made direct to the D. V. O. and are treated as urgent.

(c) A certificate is received from veterinary officers to the effect that the detraining and entraining of horses, both upon arrival and leaving camp, were properly carried out.

(d) A "marching in" and "marching out" state is furnished, reporting all casualties that may have occurred. The immediate reporting of casualties upon returning to unit headquarters is most important.

(e) Additional veterinary drugs and supplies are brought to camp and remain under the D. V. O.'s charge, from which veterinary officers posted to units in training may replenish any shortages that occur. Veterinary officers, in this connection, must confine their treatment of cases to drugs supplied. All veterinary chests have now been modernized in accordance with the advanced necessities of the practice of veterinary science.

Executive veterinary officers: A veterinary officer appointed to a station is responsible to the D. O. C., or other commanding officer, and to the D. V. O., for the efficient performance of all the veterinary duties of the station. When two or more veterinary officers are appointed to the same station, the senior is responsible.

The sick horses, the hospital buildings, veterinary stores and supplies are under the control of the veterinary officer, and the regimental staff detailed for duty with the sick are under his

orders while so employed. He arranges with the officer commanding the units, of which he is in veterinary charge, for the inspection of all animals in his professional charge, at least once a day.

During the mid-day stables hour, all matters connected with the health and efficiency of the horses should be inquired into. This is of the utmost importance, and it is ofttimes overlooked, especially in this so-called modern age, where horses are treated with contempt and neglected, or, shall we say, indifference. When possible, horses should be inspected in the open. Inspection in the stables is not conducive to efficiency; in fact, it provides a means for camouflage.

He reports to the officer commanding the unit and to the District Veterinary Officer, when necessary, in all matters relating to animals, stables, camps, transport and forage, stable management, forges and shoeing, and any measures which may, in his opinion, improve the health and efficiency of the animals at the station.

He at once reports to the officer commanding the unit, and the D. V. O., the outbreak of any contagious or formidable disease, and takes energetic steps to eradicate same. During such outbreaks, he continues to report weekly.

He is notified of the arrival of, and arranges for, the mallein test of all remounts and private horses kept in government stables, which join the units under his charge, and satisfies himself that they exhibit no symptoms of contagious disease. He is given notification of all horses about to be transferred. He makes his daily inspection of the sick not later than 9 A. M., and at all hours when necessary.

He submits the following:

(a) Daily sick report, to officers commanding units.

(b) Monthly report of sick and lame horses, to the District Veterinary Officer.

(c) Annual report, to the D. V. O.

When corps of the active militia are ordered to be placed on service, the horses of mounted units are inspected by the veterinary officer before proceeding. Any horse not fit for service is not allowed to proceed.

The Camp Commandant arranges for the inspection (and treatment if necessary) by a veterinary officer, of any horses of units or of staff officers, to which no veterinary officer has been attached.

In order to insure the regulations respecting the inspection

of horses being complied with, when ordered to proceed to camp for training, and where a veterinary officer of the C. A. V. C. has not been allotted with the unit, the officer commanding a mounted unit at once reports the fact to the D. O. C. of the military district, and asks that a veterinary officer be detailed to accompany his unit during its training.

Camps of instruction: The most important duty of an executive veterinary officer (C. A. V. C.) in peace is that of camps of instruction.

A veterinary officer should keep constantly in touch with the unit to which he is attached for duty. Directly it has been finally decided as to date his unit is to proceed to camp, he should immediately get into touch with the adjutant and arrange through him a place for the inspection of the unit's horses.

No horse should be accepted unless it is physically sound and free from all symptoms of any contagious or infectious disease and of good type (it is not policy to accept heavy draught horses or ponies for cavalry), while outlaws, kickers, or animals exhibiting vices of any description, should be rejected without any compunction, for it is useless to bring such animals to camp and expect the unit to perform its work in an efficient manner.

Camp horse claims: All horse claims arising in camp should be rendered on the Militia form provided for this purpose, and disposed of by the Permanent Horse Board, before the close of camp. (This is most important.)

Every precaution should be taken by officers commanding units to prevent minor injuries, such as rope burns, girth galls and saddle galls. Such injuries usually are due to neglect and therefore do not come under consideration from a point of view of compensation.

Disabled horses returned to owners: At the termination of the period of hire, in the case of any horse suffering from a disability or injury requiring further treatment, the owner will make the necessary arrangements for further treatment and, within 48 hours, notify the D. V. O. of the action he has taken.

The D. V. O. at once supervises the treatment and when, in his opinion, further treatment is unnecessary, he so informs the owner, stating that after the date subsequent to which, in his opinion, further treatment is not required, no further expense will be borne by the Crown.

Accounts for expenses incurred in connection with such treatment are submitted and certified to by the D. V. O., or Senior C. A. V. C. officer, and passed to the D. O. C., for transmission

to National Defence Headquarters, through the Officer Administering, C. A. V. Services.

In the event of the death or total disability of a horse, during the period of hire, the owner is paid the valuation placed upon the horse by the Permanent Horse Board, together with the amount of hire of such horse for the period for which the horse was hired.

Post-camp claims: In cases of injuries to horses on their return journey from camp, militia forms are submitted by the D. V. O., to the District Headquarters, when action is taken to compensate the owner as recommended by him, and as laid down in the regulations governing claims.

Non-permanent officers are particularly useful in the question of claims adjustment. The work of the officer administering and the D. V. O. is greatly facilitated by the veterinary officer of the unit:

(1) In that he renders a complete descriptive roll of all animals brought on the strength of the unit or units under his charge.

(2) That he enters upon same any physical defects he may detect at the time of inspection of the animals.

(3) That he takes pains to give a fair market value of all animals recorded.

(4) That he does not fail to report all sick and injured animals during camp and upon arrival at the unit headquarters following camp.

Officers commanding veterinary sections (non-permanent) should enlist only personnel who are interested in the work—young men who intend to follow the unit in all its activities. They should, during the winter months, lecture to the enlisted personnel on stable management, management of the horse in the open, minor ailments, food and feeding, evacuation of sick and injured from the field in war, destruction of horses, functions of a mobile veterinary section, veterinary evacuating station, and base veterinary hospitals in war. This is of the utmost importance, as veterinary sections operated in peace may be called upon in case of mobilization to assume the role of a veterinary hospital, V. E. S., or M. V. S., thus prepared in peace for war.

Senior veterinary officers should coöperate with the officers commanding veterinary sections and regimental veterinary officers, in working out schemes for the evacuation of sick and injured animals through M. V. S., V. E. S., and base hospitals,

via rail, canal and road. Such work greatly increases the interest of all concerned, as well as the efficiency of a unit, to a very high degree in case of mobilization.

General staff officers, assistant adjutants and Quartermaster Generals of districts are only too willing to assist in such schemes and should, when possible, include a veterinary section as a component part of any major scheme. They prepare for the mounted troops at camps of instruction (in which veterinary officers should become interested and not merely content themselves with the treatment of sick and injured animals).

To effect this state of preparedness and coöperation of non-permanent officers, the officer administering the veterinary services must make every endeavor to encourage the civilian practitioner to interest himself in army work, by liaison between permanent and non-permanent officers, selecting from the latter those of high intellect and of good standing professionally and socially.

Further, such prospective candidates should be young, of good physique, and good sportsmen. They should not be misguided as to the monetary end of their connection with the Army in peace, for with our officers this is a secondary consideration. They serve for the love of their profession and those dumb animals who cannot speak for themselves, which, after all, is the contribution of our profession to our native land under trying circumstances.

Lectures should be arranged (illustrated if possible) on work of the army veterinary services, while clinics should be provided in conjunction with state or provincial veterinary association meetings. Such clinics should be confined to veterinarians entirely. Laymen should be excluded. This permits of a full discussion of professional matters and encourages the younger members of our profession when they realize that they have the confidence of their seniors.

Encourage civil practitioners to visit camps of instruction, which are carried out during the summer months. See that civilian veterinarians are properly introduced to officers commanding units and senior officers. The social aspect is ofttimes overlooked, to the detriment of the profession.

The maintenance of a veterinary hospital, mobile veterinary section, or veterinary evacuating station, for peace training is all-important. Non-permanent officers receive more information, as to the work required of them, from such units than by any other means.

Retarded promotion within the veterinary service, by the re-

tention of senior officers who have reached the age limit, is not conducive to maintaining interest for the junior officer.

The services of those non-permanent officers who fail to attend camps of instruction or exhibit a distinct disinclination for army work, should be dispensed with, either by retirement or transfer to the reserve list. They impede the promotion of active officers and disorganize the Corps generally. Maintain the confidence of the senior officers as to the importance of the veterinary service, both in peace and war. Personally, I can think of nothing more deplorable than an inefficient Veterinary Corps in peace or war; units become immobile through lack of trained veterinary personnel. The care of countless sick and injured animals becomes a problem which cannot be remedied on short notice.

If no prearranged plan for mobilization is considered and maintained, only chaos can exist, while the profession as a whole is brought into ridicule.

Veterinary supplies and equipment: Great economy can be brought about in this connection, by both permanent and non-permanent officers. The most direct means to attain this end is to bring as few veterinary chests into use as possible in time of peace and to hold the greatest number for mobilization purposes.

The accumulation of stores, especially drugs which deteriorate, should be strictly guarded against. One general chest should be issued for peace purposes, and veterinary officers should confine the treatment of the various ailments which come under their notice to the medicines supplied, while the return of such chests should be checked as to unexpended stores and any deficiency made a charge against the officer to whom it was issued. Non-permanent officers can assist very materially in this connection.

Channel of correspondence: The use of army forms, the application of military law and regulations of the Army Veterinary Service, and other branches of the Service, should be read and understood by all veterinary officers.

You will note that a perfect liaison with the civil practitioner is all-important to a successful veterinary corps, both in peace and war.

In short, it works both ways. The permanent veterinary officer can assist the practitioner and vice versa, thus maintaining an *esprit de corps* within the profession as a whole and not merely the Corps.

Much advice can be offered. Veterinary officers are called

upon from a technical point of view to give their opinion as to the fitness of certain foods for human consumption. Their services are used also in connection with Boards and Courts of Inquiry, in the first instance for the purpose of determining the serviceability of certain articles in store or possibly the handing over of stores and equipment from one officer to another on transfer of command. While Courts of Inquiry, composed of a number of officers assembled, are for the purpose of collecting evidence, if so required, they report with regard to any matter which may be referred to them.

In brief, I have described the duties of the veterinary officers, senior and junior, and what is expected of them. Much more can be said, but time does not permit. Officers commanding permanent force units should not overlook the facilitating of non-permanent officers in all phases of their work, for it must be remembered that they are giving their time and service at great sacrifice and, after all, they are the backbone of the Army Veterinary Service, in peace and war (in countries that do not maintain a large permanent force), and further, such services, if properly utilized, mean efficiency and economy.

Further, no opportunity should be lost sight of to bring to the notice of the higher command, matters which are in the interest of the veterinary profession and the Service generally.

The importance of preventive medicine is not sufficiently stressed. The fact of having a clean bill of health amongst army horses is indicative of an efficient veterinary service.

In closing, I only wish to point out to the practicing veterinarians that it is their duty to coöperate with the officers of their Army and enter into the spirit "We Serve," and above all, be sportsmen. Then, I am sure, you will find those who have adopted the Army as a profession, humane in all respects, sportsmen of a high degree, and willing to serve within their power, in any possible way.

Drop in Milk Production

Milk production per cow was 4 per cent lower on September 1, 1932, than on September 1, 1931, and 7 per cent lower than the average for the corresponding date during the previous 5 years. The 1932 figure was the lowest reported in the 9 years for which records are available, according to the U. S. Department of Agriculture. This drop in production practically offset the nearly 4 per cent increase over the previous year in the number of milk cows on farms.

A DISCUSSION OF SOME FUNDAMENTAL PRINCIPLES AND PRACTICES UNDERLYING THE APPLICATION OF THE AGGLUTINATION TESTS FOR BANG'S DISEASE*

By C. P. FITCH *and* C. R. DONHAM
University of Minnesota, University Farm
Saint Paul, Minn.

Numerous investigators have contributed to our knowledge of the agglutination phenomenon as it is applied in the diagnosis of disease. Most of the studies of this phenomenon in veterinary medicine have been carried out with the test-tube method of conducting an agglutination test. During recent years, some workers have used and investigated the rapid method of agglutination testing. The remarks in this discussion are based on studies in our laboratory, some of which are as yet unpublished.

The rapid agglutination test appears to be dependent on some of the same basic principles as the test-tube method. In both methods the reaction results from the activity of specific agglutinins on the bacteria in the presence of electrolytes. Our work has shown that the agglutinating forces in the two methods are different and these variations must be considered for a proper understanding of the rapid test. One essential difference arises through the fact that the ratio of serum to antigen is widely different in the two methods of testing. In the technic of the test-tube method the amount of agglutinating serum in ratio to the quantity of saline solution in the antigen is always relatively small. In this method, the agglutinating serum is always highly diluted with saline solution. The amount of serum is so small in ratio to the amount of antigen that it is generally disregarded in stating the dilutions employed. It is, however, always in error from a mathematical point of view. For example, in the test-tube method, 0.04 cc of serum in 1 cc of antigen is usually considered as a dilution of 1 in 25. This is actually a dilution of 1 in 26. In other dilutions employed in the test-tube method, the ratio of serum to antigen is changed, but the variations in the different dilutions are so small that their influence on the bacterial concentration of the antigen and on the agglutination reaction is not perceptible and is properly disregarded.

*These studies were made possible by a grant from the Bureau of Animal Industry, U. S. Department of Agriculture. Paper No. 1127 of the Journal Series of the Minnesota Agricultural Experiment Station. Presented at the sixty-ninth annual meeting of the American Veterinary Medical Association, Atlanta, Ga., August 23-26, 1932.

An entirely different situation is encountered in the technic of the rapid method. Here there is a relatively large proportion of serum to antigen. The serum-antigen mixture in the rapid-test method frequently contains more serum than antigen; *e. g.*, in a mixture of 0.08 cc of serum + 1 drop (approximately 0.03 cc) of antigen, the serum constitutes more than ¾ of the total volume of the serum-antigen mixture. This ratio changes markedly in the several serum-antigen mixtures of the rapid test; *e. g.*, in a mixture of 0.005 cc of serum + 0.03 cc of antigen, only 1/7 of the serum-antigen mixture is serum. Table I shows the proportion of serum in the total volume of the serum-antigen mixtures of typical technics of conducting both the rapid and test-tube methods.

This relatively large proportion of serum to antigen in the rapid-test method changes the set-up in a manner that results in

TABLE I—*Ratio of amounts of serum to total volume of serum-antigen mixtures for rapid and test-tube methods of agglutination testing.*

	Typical Dilutions of Test-Tube Technic				
	Undiluted Serum			Serum Diluted 1 in 10 with Saline Solution*	
	1:25	1:50	1:100	1:250	1:500
Amount of serum (cc)	0.04	0.02	0.01	0.004	0.002
Amount of antigen (cc)	1.0	1.0	1.0	1.0	1.0
Total volume of serum-antigen mixture (cc)	1.04	1.02	1.01	1.04	1.02
Ratio of amount of serum to total volume of serum-antigen mixture	1 in 26	1 in 51	1 in 101	1 in 260	1 in 510
	Typical Serum-Antigen Mixtures of Rapid Test that Usually Give Agglutination Titres Comparable to Above Dilutions				
Amount of serum (cc)	0.08	0.04	0.02	0.01	0.005
Amount of antigen (1 drop) in cc (approximately)	0.03	0.03	0.03	0.03	0.03
Total volume of serum-antigen mixture (cc)	0.11	0.07	0.05	0.04	0.035
Ratio of amount of serum to total volume of serum-antigen mixture	8 in 11	4 in 7	2 in 5	1 in 4	1 in 7

*The amounts of diluted serum added to the antigen are 10 times the actual amounts of serum given.

the introduction of certain agglutinating forces in addition to those encountered when the test-tube method is followed.

For purposes of expression, let us say that the rapid-test method (relatively slight dilution of agglutinating serum with the saline solution in the antigen) brings out and magnifies certain agglutinating forces that are probably present, but not perceptible in the test-tube method where the dilution of the serum is vastly greater.

It is evident that the final bacterial concentration of the antigen in rapid-test serum-antigen mixtures is markedly affected by the proportion of the amounts of serum and antigen. Table II shows this effect when using a rapid-test antigen having 10 per cent bacteria by the centrifuge-tube method.

TABLE II—*Effect of dilution of rapid-test antigen with agglutinating serum on the final bacterial concentration.*

TYPICAL RAPID-TEST SERUM-ANTIGEN MIXTURES IN CC	TYPICAL BACTERIAL CONCENTRATION OF ANTIGEN BEFORE ADDITION OF AGGLUTINATING SERUM	FINAL BACTERIAL CONCENTRATION OF ANTIGEN
0.08 serum 0.03 antigen	10 per cent	2.7 per cent
0.04 serum 0.03 antigen	10 per cent	4.3 per cent
0.02 serum 0.03 antigen	10 per cent	6.2 per cent
0.01 serum 0.03 antigen	10 per cent	7.7 per cent
0.005 serum 0.03 antigen	10 per cent	8.6 per cent

Thus the final bacterial concentration of the antigen does not remain even approximately uniform in the different dilutions employed in a single rapid test. It is apparent that any understanding of the influence of the bacterial concentration of the antigen on agglutination titres obtained with rapid-test antigens must consider this point. It is also evident that the rapid-method technic would provide an extremely complicated unsatisfactory measure of relative amounts of agglutinin in the serum if the titre in rapid tests were solely or even primarily dependent on the bacterial concentration of the antigen.

Experimental evidence has been obtained which shows that the saline solution in the antigen has an inhibiting influence on

the agglutination reaction in the rapid-test method, presumably because of its effect in diluting the agglutinating serum. This has been demonstrated in several different ways. The experimental results shown in table III will illustrate this point. Electrolytes are essential for agglutination. This inhibiting influence of the saline solution is not due to the electrolytes but rather is apparently due to the effect of the water used as a vehicle for the electrolytes. Necessarily this inhibiting influence is not uniform in the several serum-antigen mixtures of a single rapid test because the degree of dilution of the serum with the saline solution of the antigen is not uniform. On the contrary, in the test-tube technic, this inhibiting influence must be essentially uniform in the several dilutions of a single test because all the serum amounts are highly diluted with the saline solution of the antigen. Apparently the variation in the degree of dilution of the several amounts of serum used in a single test-tube test is not sufficient to result in perceptible differences in this inhibiting influence as it operates in one dilution of the test-tube technic as compared to the other dilutions.

Thus we see that this inhibiting influence of the saline solution in the antigen is probably present but not perceptible in

TABLE III—*Effect of dilution of the serum-antigen mixture on the agglutination titres of bovine sera.*

SERUM*	0.03 CC ANTIGEN	0.06 CC ANTIGEN	0.03 CC ANTIGEN + 0.03 CC 12% SALINE SOLUTION	0.03 CC ANTIGEN +0.03 CC NEGATIVE BOVINE SERUM
153	+ + + I I	+ + I I −	+ + I I −	+ + + + +
405	+ + + I I	+ I I − −	+ + I − −	+ + + + +
185	+ + + I −	+ I − − −	+ I − − −	+ + + + +
413	+ + + I −	+ + − − −	+ + − − −	+ + + + +
146	I − − − −	− − − − −	− − − − −	I I I − −
147	I I − − −	− − − − −	− − − − −	I I I − −
148	I I − − −	− − − − −	− − − − −	I I I − −
149	+ + I − −	I − − − −	I − − − −	+ + + + −
129	+ I − − −	− − − − −	− − − − −	+ + I − −
138	I I − − −	− − − − −	− − − − −	I I I − −
139c	− − − − −	− − − − −	− − − − −	I − − − −
21	− − − − −	− − − − −	− − − − −	− − − − −

+ = complete agglutination.
I = incomplete agglutination.
— = no agglutination or only a trace of agglutination.
*Amounts of serum: 0.04, 0.02, 0.01, 0.005 and 0.0025 cc. Time of observation: 8 minutes.

the test-tube method, but has been shown by several different experiments to be important in the rapid-test method.

It has been shown that the agglutination phenomenon operates in a quantitative manner in the tube test. That is, the titre primarily depends on a ratio between agglutinin content of the serum and numbers of bacteria in the antigen regardless of the amount of saline solution used to suspend the bacteria. Thus, when the bacterial concentration of the antigen is increased, the agglutination titres are reduced. Such a relationship cannot be demonstrated to the same degree in the rapid test. Other agglutinating forces (introduced in part by the difference in the ratio of amounts of serum to amounts of antigen) present in the rapid test change the entire set-up and we find that these other forces become more important and the bacterial concentration of the antigen becomes less important in determining agglutination titres.

We have shown, further, that antigens prepared by suspending the bacteria in normal negative bovine serum (no specific agglutinins for *Bact. abortus*) are more sensitive than antigens prepared by suspending the bacteria in saline solutions. Also that the inhibiting influence of saline solutions mentioned above can be overcome largely, if not entirely, by the addition of such materials as gelatin or acacia to the saline solutions used to suspend the bacteria in preparing either test-tube or rapid-test antigens.

Some laboratories that are producing rapid-test antigens are including small amounts of gelatin in such antigens to increase their sensitivity. It has been difficult to produce rapid-test antigen that was sufficiently sensitive without the addition of gelatin or some other material having a similar effect on the sensitivity of antigens. In our experience, gelatin markedly increases the sensitivity of rapid-test antigens for tests of most agglutinating sera but not all sera. The explanation of why two sera having identical test-tube titres respond differently with rapid-test antigens containing gelatin cannot be given. It is relatively easy to cause the antigen to become too sensitive for most agglutinating sera if too much gelatin is used.

Table IV shows typical results of tests with a series of antigens containing various amounts of gelatin and varying bacterial concentrations.

As would be expected, other experiments have demonstrated that dilution of rapid-test antigen with agglutinating serum (change in bacterial concentration of antigen) does not have

the same effect on the agglutination titres as dilution of the antigen with saline solution. This constitutes at least a part of the explanation of why it has been possible to devise a system of serum-antigen mixtures for the rapid-test method which gives

TABLE IV—*Effect of gelatin on the sensitivity of rapid-test Bact. abortus antigen.*

SERUM	CONCENTRATION OF GELATIN	BACTERIAL CONCENTRATION OF ANTIGEN				
		5%	10%	12%	15%	20%
163	None	++−−−	++−−−	+I−−−	+I−−−	+I−−−
	0.2%	++I−−	++−−−	++−−−	+I−−−	+I−−−
	0.4%	+++I−	++I−−	++I−−	++−−−	++−−−
	0.6%	++++I	+++I−	++I−−	++I−−	++I−−
	0.8%	+++++	+++II	+++I−	++I−−	++I−−
	1 %	+++++	+++II	+++I−	+++I−	++I−−
	3 %	+++++	+++II	++I−−	++I−−	++−−−
	5 %	+++I−	+++−−	++−−−	+−−−−	I−−−−
551D	None	−I−−−	I+I−−	++I−−	+II−−	+I−−−
	0.2%	I+II−	I+I−−	+++−−	+++I−	++−−−
	0.4%	I+++I	+++I−	+++I−	+++I−	++I−−
	0.6%	I++++	++++I	+++++	++++−	++I−−
	0.8%	I++++	+++++	++++I	++++−	++I−−
	1 %	I++++	+++++	++++−	++++I	++I−−
	3 %	+++++	+++++	++++−	+++I−	++−−−
	5 %	++++I	+++I−	+++−−	+I−−−	+I−−−
162	None	++−−−	++I−−	+I−−−	+I−−−	+I−−−
	0.2%	++−−−	++I−−	+II−−	+I−−−	+I−−−
	0.4%	++−−−	++I−−	+II−−	+I−−−	+I−−−
	0.6%	++I−−	++I−−	+II−−	+I−−−	III−−−
	0.8%	++I−−	++I−−	+II−−	+I−−−	++−−−
	1 %	++I−−	++I−−	+II−−	III−−−	III−−−
	3 %	++II−	++−−−	+I−−−	II−−−	I−−−−
	5 %	+II−−	+I−−−	+I−−−	I−−−−	III−−−
547	None	+++I−	+++−−	++I−−	++I−−	++I−−
	0.2%	+++I−	+++−−	+++−−	+++−−	++I−−
	0.4%	++++I	+++I−	+++−−	+++−−	+++−−
	0.6%	++++I	+++I−	+++I−	+++−−	+++−−
	0.8%	+++++	+++I−	+++I−	+++I−	+++−−
	1 %	+++++	+++II	+++II	+++II	+++−−
	3 %	+++++	++++I	++++I	++++I	+++−−
	5 %	+++++	++++I	++++I	++++I	+++−−

Time of observation: 8 minutes.
Amounts of serum: 0.08, 0.04, 0.02, 0.01, 0.005 cc.
Amount of antigen: 0.03 cc.
Test-tube dilutions: 1:25, 1:50, 1:100, 1:250, 1:500, 1:1000.
Test-tube titres: Serum 163, + I I — — —; serum 551, + + + I — —; serum 162, + + I — — —; serum 547, + + I — — —.

agglutination titres that approximate those obtained by the test-tube method.

Other experiments have shown that the number of bacteria that are agglutinated by a given amount of agglutinin is greater in the rapid test than in the tube test, presumably because there is less saline solution in the rapid-test serum-antigen mixtures and consequently less of its inhibiting influence. Thus it is not feasible to standardize the sensitivity of rapid-test antigens by maintaining the same ratio of agglutinin content to number of bacteria (with less saline solution in the antigen), as is used in the test-tube method. In other words, it appears that the trial and error method is the only one that can be used to devise a system of serum-antigen mixtures for the rapid technic which gives agglutination titres approximating those obtained by the test-tube method.

The relatively large proportion of serum to antigen in the rapid test may complicate the situation in other ways. It has been relatively common, in our experiments, to encounter two agglutinating sera having identical test-tube titres that have not responded in the same manner with various kinds of rapid-test antigens. The causes for such differences in the rapid-test titres of sera cannot be given. Perhaps they arise through differences in the properties of the sera exclusive of the agglutinin or perhaps through differences in the agglutinin itself. If the former is the cause, possibly these differences are associated with such phenomena as "pro-agglutination" or "con-agglutination." It would seem logical to assume that if such factors do influence the agglutination reaction, there would be more opportunity for this influence to be manifested in the serum-antigen mixtures of the rapid test, with its relatively large proportion of serum to antigen, than in the tube-test, with the relatively small amounts of serum in proportion to the amounts of antigen. These differences in the titres of two sera tested by the rapid method might be associated with differences in the physicochemical properties of the sera (exclusive of its agglutinin content) which in turn alter the properties of the serum-antigen mixtures and thereby alter the agglutinating forces and the resulting titres. Experiments in our laboratory have shown, for example, that bovine sera as they are used in serological work, show perceptible, consistent differences in surface tension and viscosity. So far no relation has been observed between differences in surface tension or viscosity of sera and their agglutination titres. Some studies of the test-tube method, reported in the literature (Tittsler and Lisse), would suggest this hypothesis. Again, if such factors do influ-

ence agglutination titres, it would be expected that they would be more apparent in the rapid-test method. On the other hand, perhaps these variations in the rapid-test titres of two sera having identical test-tube titres may arise through variations in the "quality" of the agglutinin in contrast to the "quantity."

It is evident that the results obtained by the rapid method are much more susceptible to errors due to the human element if this method is used by a large number of individuals as a field test. The test-tube method is practical only in a laboratory and this automatically limits the number of persons conducting the test. Thus, from the standpoint of the human element alone, the laboratory test will be more accurate than the field test. On the other hand, most workers agree that no large amount of progress in the control of this disease can be anticipated until an accurate method of diagnosis in the field is available. Satisfactory progress will not be made in the control of this disease until larger numbers of animals are tested. It is likely that the rapid method as a field test will reach many times the numbers of animals than are now being tested by the test-tube method. It may be advisable, under certain circumstances and in some localities, to adopt the rapid-test as a field diagnosis method, even if such a policy might involve sacrificing a small degree of accuracy, in order that more animals be tested and more rapid progress be made in the control of Bang's disease.

We should not attach too much importance to the variations in results obtained by the two methods because they are of relatively minor importance from a percentage standpoint as we have indicated in a previous publication. However, our studies of the agglutination phenomenon, as used in both the test-tube and rapid-test methods, have caused us to believe as follows regarding the causes for discrepancies in the tests: First, that no one factor is responsible for a major portion of the discrepancies. Second, that a number of factors contribute minor percentages of the errors. Third, that the aggregate of all the discrepancies in the results of this test constitute a problem worthy of attention. Fourth, that attempts to improve this method of diagnosis should be directed towards minor sources of error. Fifth, that each test, the rapid and test-tube method, should be standardized each by itself and not one on the other. They involve some different elements of activity and each should be given its respective place.

DISCUSSION

DR. H. L. GILMAN: I am glad that you brought up that point about 1:25, because I think there is some misunderstanding as to what it means—whether it is 1 *to* 25 or 1 *in* 25. When I first started out, I looked up that point in most of the standard books on serology, and my opinion is that we should use 1 *in* 25. I have been following that ever since. I think we should get together and standardize that term as well as other things. We should all make it either 1 *to* 25 or 1 *in* 25. I wonder if some of us do not use 1 *in* 25 and others 1 *to* 25. One *to* 25 is what you use?

DR. FITCH: Yes.

DR. GILMAN: It is really 1 in 26?

DR. FITCH: Yes.

DR. E. M. PICKENS: I presume we are dealing with colloidal forces in connection with the addition of the antigen. In this case, it would seem that the addition of gelatin would increase the sensitivity at the expense of the accuracy of the test. I understand from Dr. Fitch that he has checked that and does not find any material difference.

DR. FITCH: There is no material difference.

DR. E. T. HALLMAN: To what extent are you disregarding the use of the rapid-test method? The Department of Agriculture has been disregarding it to some extent, and we are influenced to a great extent by what others decide.

DR. FITCH: At the present time we are maintaining a neutral position. I am neither a prophet nor the son of a prophet, but I would be willing to say that, if we live our allotted three score and ten, we will see the rapid-test method generally used in this country. I might say in closing that we have found no essential difference in the results of the two tests in our laboratory, except in certain rare cases, the explanation of which we have not yet determined.

DR. R. R. BIRCH: Are these negatives or positives that you get most of the time?

DR. FITCH: Positives.

Meeting Dates Changed

A change has been made in the date of the winter meeting of the Wisconsin Veterinary Medical Association, according to information from Dr. B. A. Beach, Secretary. The meeting will be held at Madison, January 10-11, 1933, with a clinic on the afternoon of the 11th, instead of January 9-10-11, as previously announced.

The meeting of the Missouri Veterinary Medical Association and the special course for graduate veterinarians, to be held at the University of Missouri, will take place at Columbia, January 24-27, 1933, instead of January 23-28.

Live Stock Income vs. Crop Income

Estimated gross income from live stock on farms during 1932 amounted to 48 per cent of the 1929 income, while income from crops was only 42 per cent of the 1929 amount, according to the U. S. Department of Agriculture.

TREATMENT FOR MASTITIS WITH ULTRAVIOLET LIGHT, FORMALIN, COLLOIDAL CARBON AND AUTOGENOUS BACTERINS*

By E. M. GILDOW, H. C. HANSEN *and* V. A. CHERRINGTON†
University of Idaho, Moscow, Idaho

Mastitis, or inflammation of the udder, is undoubtedly one of the most common and generally prevalent diseases of dairy cattle. It is a serious disease from both an economic and public health standpoint. Mastitis probably is responsible for a greater loss to the dairyman than any other disease of dairy cows, with the possible exception of Bang's abortion disease. Sanitarians consider milk from udders affected with streptococcic mastitis as responsible for many epidemics of sore throat.

Very little will be mentioned concerning the cause and forms of mastitis in this paper except to state that the majority of cases are caused by streptococcic infections and usually develop into a subacute or chronic phase of the interstitial and parenchymatous forms. Sholl and Torrey[1] state that interstitial mastitis occurs as a subacute or chronic process involving primarily the interstitial tissue. In more acute cases the parenchyma becomes involved.

Subacute mastitis is characterized by the production of flaky milk and a slight inflammation of the affected quarters. These symptoms may be accompanied by slight swelling, hardening, or fever in the diseased glands. The affected cow does not usually show evidence of general fever or loss of appetite. Milk production is often slightly diminished.

Chronic mastitis is characterized by high bacteria and high leucocyte counts on milk samples. Occasionally slight clinical manifestations are shown in the form of flaky milk. Subacute and chronic mastitis usually follow an acute attack. Indurations of portions of the udder are usually prevalent in quarters that have been affected with acute mastitis. These fibrous areas may be associated with both the subacute and chronic forms.

Probably the most common treatment for acute and subacute mastitis is the application of hot packs supplemented with a laxative, the use of udder ointment, and frequent milking. If such treatment is instituted early, it is usually adequate for re-

*Published with the approval of the Director as paper No. 89 of the Idaho Agricultural Experiment Station. Presented at the sixty-ninth annual meeting of the American Veterinary Medical Association, Atlanta, Ga., August 23-26, 1932.

†Members of Departments of Animal Husbandry, Dairy Husbandry and Bacteriology, respectively.

lieving the clinical symptoms of such cases. Evidence indicates, however, that such cases are not completely cured, since chronic mastitis associated with the discharge of large numbers of bacteria still persists in most instances. This is particularly true where streptococci are responsible for such cases. Minett[2] states that complete cure cannot be effected by any method of treatment now available.

The remedial effect of methods of treatment most often has been measured by improvement in the clinical symptoms of the disease rather than by a definite check on the bacteria and leucocyte content of the milk as an index of the status of the disease.

This report gives the results of attempts to control cases of mastitis by the application of four different methods of treatment. The value of each treatment was measured largely by its ability to reduce the high bacteria and leucocyte counts that prevailed. The first treatment tried was the application of ultraviolet light to the affected quarters. Examples of generally recognized treatments also used were formalin per os, colloidal carbon intravenously, and autogenous bacterins subcutaneously.

In order to measure the specific effect of each treatment, no supplementary treatment was employed. For instance, the cow was not given a laxative nor was she milked more than the usual number of times daily.

In the past, annual, semi-annual and, recently, quarterly bacteriological examinations have been conducted on samples of middle milk from each quarter of all milking cows in the Station dairy herd. This practice has revealed what are called high-bacteria-count or high-leucocyte-count cows. Such cows often are found to be suffering from subacute or chronic mastitis. Aseptically drawn milk samples from affected quarters of the udders of these cows persistently show abnormally high bacteria counts or high leucocyte counts, or both. Generally, these high-count cows have a tendency to develop acute or subacute mastitis at irregular intervals.

Data obtained by Cherrington, Hansen and Halversen[3] at this Station, consisting of approximately 1,000 bacteria and 1,000 leucocyte counts indicate that cows affected with mastitis nearly always show more than 100,000 leucocytes per cubic centimeter of milk. A single low bacteria count on aseptically drawn milk is not a safe basis for a diagnosis. However, where a series of bacteria counts are made showing counts above 10,000 per cc, it is safe to conclude that the udder is infected.

Clinical data were taken and milk samples were plated prior

to the institution of treatment in every case and also at daily or two-day intervals during the treatment. Bacteria counts were made by plating the milk on standard nutrient agar and also nutrient agar to which had been added one per cent dextrose and five per cent sterile defibrinated horse-blood. Bacteria counts on plain and blood agar compare favorably, but the colonies on blood agar were much easier to count. Leucocyte counts were made according to the Prescott and Breed technic. Further determinations were made as a check soon after the treatments were completed and again, in most instances, after the cow freshened. High-producing cows, with records that average 20,000 to 25,000 pounds of milk yearly, were used. This herd has been free from tuberculosis and Bang's abortion disease for the past three years.

Ten cases of mastitis were treated in this study. All were treated soon after the disease showed up, so were not allowed to develop into severe cases. Five of them were treated with each of the four methods. Four of the five other cases were treated with more than one method. Each method, however, was checked separately. Most cases were treated first with ultraviolet light. This treatment was very efficient in controlling the clinical symptoms of the disease. A report dealing with this phase of the study is being prepared. Subsequent treatments were used in an endeavor to reduce or eliminate the high bacteria and leucocyte counts that prevailed. Very little can be said, therefore, in regard to the effect of such subsequent treatments on clinical improvement.

Seven of the causative organisms isolated were streptococci and three were staphylococci (table I). In each instance, a single species was responsible for the infection.

Ultraviolet Light Treatment

Ultraviolet light is known to have a curative effect on rickets. Furthermore, it has a stimulative and curative effect on certain skin diseases. It is said to have a beneficial physiological effect on the system in that it increases the tone and strengthens the resistance of the body against disease. It seemed possible that by applying ultraviolet light directly to the affected mammary tissue, it would exert both a local and systemic stimulation and thus assist the body in eliminating the infection responsible for mastitis.

In several preliminary cases, some of which were severe and acute, this treatment was very effective in controlling the clinical symptoms. In order to determine the possible effect of this light

on the bacteria and leucocyte counts, seven additional cases were treated.

The source of the ultraviolet light used in these tests was the Cooper-Hewitt-Uviarc poultry treater. The light was held approximately twelve inches from the udder for fifteen minutes twice daily, for five-day periods, before milking. After a three-day interval, the treatment was applied in a like manner, after milking. In six of the seven cases, ultraviolet light was the first treatment used in an attempt to control the excessively high bacteria and leucocyte counts.

Most of these cases were showing mild clinical symptoms of mastitis. The symptoms in general consisted of flakes in the milk, or slight swelling and inflammation. In every instance clinical symptoms subsided after a few treatments. All of these cases except cow 71 showed high bacteria counts and all of them high leucocyte counts before treatment (figs. 1 and 2). There was no reduction of either bacteria or leucocyte counts accompanying the disappearance of clinical symptoms. The causative organism still remained in the udder in each case.

TABLE I—*Forms of mastitis, types of infection, and treatment used in attempts to reduce the high bacteria and leucocyte counts on middle milk.*

Cow	Type of Infection	Form of Mastitis	Quarters Affected	Kinds and Order of Treatments Used			
				Ultra-violet Light	Formalin	Colloidal Carbon	Autogenous Bacterin
54	Streptococcus*	Mild catarrhal	All	1	2	3	4
55	Streptococcus*	Mild catarrhal	All	2			1
61	Streptococcus†	Severe catarrhal	All				1
65	Streptococcus*	Mild catarrhal	Left front	1	2	3	4
71	*Staphylococcus epidermidis*	Mild catarrhal	Right rear	1	2	3	4
80	*Streptococcus subacidus*	Mild catarrhal	Left rear	1			2
86	Streptococcus†	Severe catarrhal	Left rear		1	2	
88	*Micrococcus varians*	Subacute parenchymatous	Right front	1			2
139	Streptococcus†	Mild catarrhal	Both rear		1	2	
141	*Staphylococcus epidermidis*	Mild catarrhal	Right front	1	2	3	4

*An undescribed species.
†Unclassified.

These results strengthen the viewpoint commonly held that mastitis in most instances is not cured by treatment, as shown by the persistent high bacteria and leucocyte counts in these cases even when clinical symptoms were reduced.

Formalin Treatment

The use of formalin in the treatment of mastitis was first recommended by Frost.[4] He states that formalin could be detected in the milk two hours after the administration of 25 cubic centimeters per os and that traces could be detected in the milk by the use of Leach's hydrochloric acid test up to 48 hours after being given. He further reports that four cases showing streptococci before treatment were entirely free of organisms when the milk was cultured afterwards. One of these cases was still free five months later, in another lactation period.

Seddon[5] treated two cases of mastitis in cows according to Frost's technic, with negative results. He was furthermore unable to detect any evidence of formalin in the milk.

Savage[6] reports satisfactory results in the treatment of eighteen cases of acute mastitis with formalin, supplemented with a saline purgative, frequent milking, massage, and udder ointments. No bacteriological data following treatment were given.

In the present investigation, seven cows were used in the study of this method of treatment. Each cow was drenched with one ounce of formalin in a quart of diluted blackstrap molasses at daily intervals for four or more days. Five of these cows were treated with ultraviolet light and two by the hot-pack method prior to the use of the formalin treatment (table I). Clinical symptoms, therefore, had subsided before the formalin treatment was begun but the bacteria and leucocyte counts were still very high.

During the early part of this study on the effect of formalin in the treatment of mastitis, the Leach test for formalin was made on the milk at each milking. Cow 65 received one ounce of formalin daily for nine days. At no time was formalin detected in the milk. Every test was checked against milk containing a minute quantity of formalin.

No consistent reduction was found in either bacteria or leucocyte counts following treatment (figs. 1 and 2). This was borne out in subsequent quarterly tests. This would indicate, in these cases at least, that formalin did not eliminate the infection from udders of cows affected with mastitis.

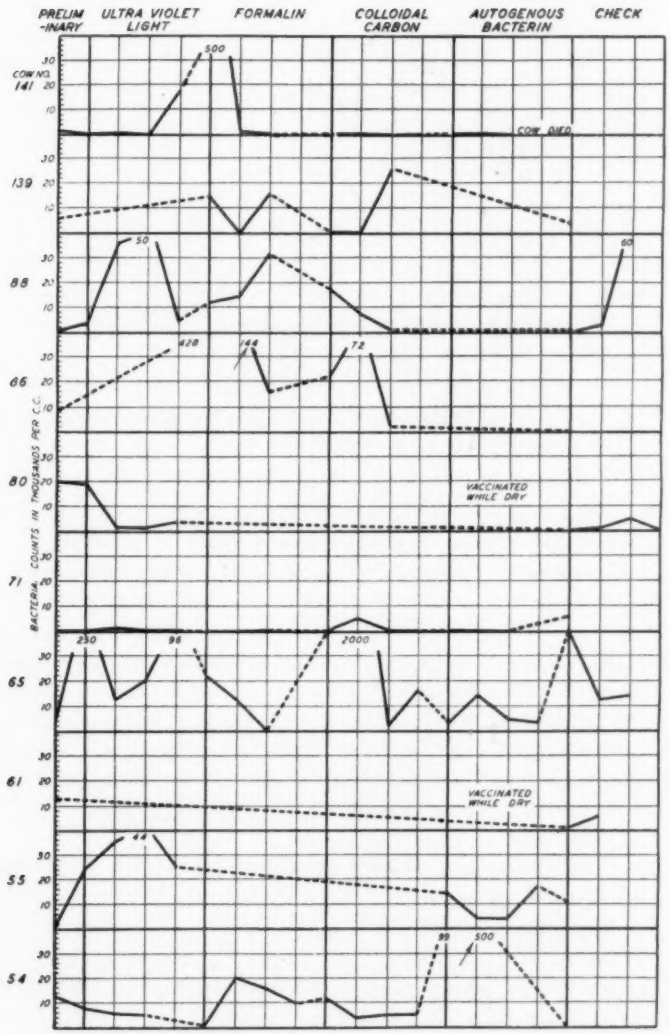

FIG. 1. Graphs showing bacteria counts in thousands per cubic centimeter, on the milk of cows affected with mastitis, as a measure of the effect of the treatments indicated. The dotted lines represent periods between treatments.

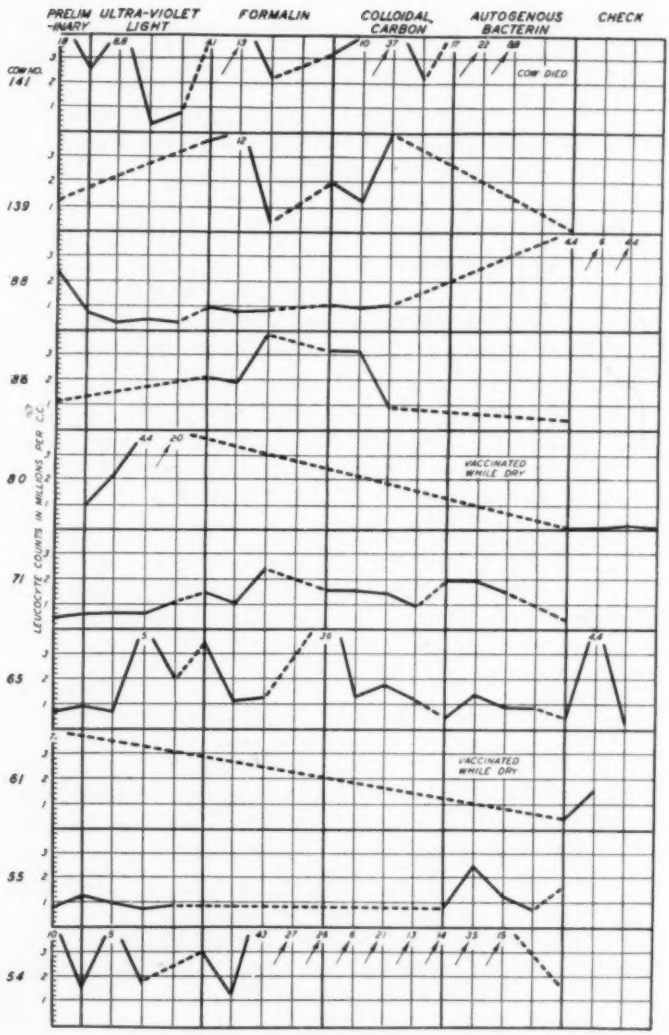

FIG. 2. Graphs showing leucocyte counts in millions per cubic centimeter, on the milk of cows affected with mastitis, as a measure of the effect of the treatments indicated. The dotted lines represent periods between treatments.

COLLOIDAL CARBON

Conklin[7] showed that the intravenous injection of colloidal carbon greatly increased the number of polymorphonuclear leucocytes in the blood. He further asserts that it increased the phagocytic properties of leucocytes and raised the opsonic index. Beneficial results were obtained in the treatment of over 100 cases of septicemic and pyogenic infections, including mastitis cases in domestic animals. He gives one case report in which colloidal carbon was recommended and used with good results after the formalin treatment and other methods had failed. No bacteriological data are given in proof of the presence or elimination of an infectious agency.

In the investigation here reported, six cows suffering with mastitis were treated with colloidal carbon in the form of Kollo-Karbo (Jen-Sal). Each cow received three 50-cc intravenous injections at intervals of two or more days. In some cases a portion of one injection did not gain entrance to the vein. In each case some other treatment had been employed to reduce the number of bacteria and leucocytes without success before colloidal carbon was injected. Clinical symptoms had practically disappeared before this treatment.

Blood counts made before and after injections of colloidal carbon showed an appreciable increase in leucocytes in most instances. Bacteria counts revealed a slight reduction in number following treatment in all cases except cow 139 (fig. 1). This reduction was neither paralleled by a reduction in leucocyte count, nor was it found to be permanent, as shown by subsequent quarterly tests.

Evidence obtained from these few cases indicates that the intravenous injection of colloidal carbon is not a satisfactory method of eliminating the high bacteria and leucocyte counts associated with and following an attack of mastitis.

AUTOGENOUS BACTERINS

Autogenous bacterins and vaccines have been used extensively for some time in the control of mastitis. In most instances the results obtained have not been checked by bacteriological examinations of the milk. Reference has already been made to Minett's statement that no present known method of treatment is efficient in eliminating the organisms responsible for mastitis. Brigham, McAlpine and Anderson[8] found that autogenous bacterins were of distinct benefit in controlling severe cases of streptococcic mastitis but that the infection generally persisted,

remaining in the udder even through dry periods of six to twelve months. They state that few cases were found in which the organism was permanently eliminated. Carpenter[9] reported satisfactory results with a living alpha hemolytic streptococcic vaccine in a herd of 123 cows. Numerous other references are available in the literature concerning treatment for mastitis with vaccines.

Eight cases of mastitis were treated with autogenous bacterin in this study. Each cow was injected subcutaneously on alternate days, or at greater intervals, with an autogenous bacterin. Generally three injections of 4, 8 and 12 cc, respectively, were used. The bacterin compared in density with standard 3 of the McFarland nephelometer. Three of these cows (61, 86 and 88) received larger doses of autogenous bacterin, ranging from 10 to 25 cc at each injection. Cow 54 was given a second series of injections four months following the first. Six of these cows had received other forms of treatment before the autogenous bacterins were used. An autogenous bacterin was used on two cows as the initial treatment. One of these cows was dry during treatment and the other did not show clinical symptoms. There was no uniform reduction in the bacteria content of milk following treatment and no general reduction of leucocytes. Cow 80, however, did show a distinct drop in both bacteria and leucocytes—an improvement which seems permanent. She has shown no clinical or bacteriological evidence of garget for 14 months since treatment. Counts taken three to twelve months after vaccination on the other cases, in regular quarterly tests, did not show any consistent reduction in either bacteria or leucocytes.

Discussion

In this work emphasis has been placed on the bacteria and leucocyte counts on middle-milk samples in determining the effectiveness of the treatments applied. This was thought advisable since regular bacteria and leucocyte counts on the middle milk from each quarter of every lactating cow in the herd showed that certain cows persistently produced milk high in both bacteria and leucocytes. These high-count cows were usually individuals that had suffered periodic attacks of mastitis.

Many cows appear to recover spontaneously from mastitis. Such individuals, however, as well as those that apparently recover following treatment, tend to have recurrent attacks. This in itself indicates that there is probably some retention of the infectious agency.

The location and special adaptability of the organism is pos-

sibly responsible for its retention. Such at least appears to be the case in streptococcic mastitis (Sholl and Torrey[1]).

This constant presence of excessive numbers of bacteria and leucocytes in the milk from cows that suffer from infectious mastitis is a serious menace to human health. Some method of eliminating the infection seems necessary from the standpoint of economy as well as public health.

SUMMARY

No consistent reduction in the number of bacteria or leucocytes in the middle milk of cows affected with subacute or chronic mastitis was obtained following treatment with formalin, colloidal carbon, autogenous bacterins or ultraviolet light.

Four cows (54, 65, 71 and 141) were treated by all four methods without showing significant reductions in bacteria or leucocyte counts.

Of the ten cows treated with two or more of these methods, only one (cow 80) shows a permanent recovery, as designated by a return to a normal bacteria and leucocyte count in the milk. This cow was infected with *Streptococcus subacidus*. She was treated first with ultraviolet light in September, 1930, and with autogenous bacterin in March, 1931. Both the bacteria and leucocyte counts were normal following the use of autogenous bacterin and have remained so on subsequent quarterly herd tests.

No conclusive statement can be made concerning the relative effectiveness of the different treatments used insofar as correction of clinical symptoms is concerned. The limited data obtained in the treatment of these cases, however, do corroborate the findings of other investigators in that none of the treatments used was effective in eliminating the causative organism from the udder or even in regularly reducing the number of organisms or associated leucocytes.

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PULLORUM DISEASE
A Study of the Relationship of Repeated Agglutination Tests to the Bacteriology and Pathology of the Disease*

By FRANK D. MCKENNEY, *Rochester, Minnesota*

Division of Experimental Surgery and Pathology
The Mayo Foundation

Probably one of the greatest scourges with which the poultry industry has had to contend is pullorum disease, or bacillary white diarrhea. Although the etiology and transmission of pullorum disease among young chicks has been demonstrated definitely, two important aspects of this disease which need further study are the more exact methods for its detection, and the extent of the contagion among mature fowls.

The macroscopic agglutination test, or some modification of it, has been advocated as a means of eradicating the disease among mature fowls. However, these methods have been subjected to severe criticism by some experimenters, even to the point of excluding them as a means of diagnosis. Others have shown these tests, on the basis of experimental work, to be suitable and, if correctly conducted, rather reliable procedures for discovering fowls affected with pullorum disease.

The degree of transmissibility of the disease among mature fowls and the importance of the male fowl as a factor in disseminating the infection are still unsettled. It is generally accepted that a positive titre to the agglutination test will develop in adult fowls if they are fed the organism, but whether the subsequent infection becomes localized in the ovary, or is maintained elsewhere in the body, needs further experimental investigation. The percentage of adult fowls in which the infection localizes in the ovary is significant, because fowls without such localization probably would not transmit the disease through the egg and in this respect would not be so dangerous as the fowls harboring the organism in the ovary.

The experimental data presented here are concerned with pullorum disease as it affects adult fowls. The fate of *Salmonella pullorum* after it has been fed to susceptible fowls has been studied. Particular attention has been given to fowls thus affected to discover whether they may eliminate the infection

*Abridgment of thesis submitted to the Faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree Master of Science, 1931. Received for publication, February 15, 1932.

and recover, become immune, or carry a localized infection. Adult fowls that had become infected spontaneously are included in the study as well as those that are normal and uninfected. It is desirable to know the meaning of the response of various fowls to the agglutination test.

Methods of Investigation

The data forming the basis of this report were collected in the last two and one-half years, during which time a total of 996 fowls were tested from two to fourteen times, at varying intervals. All of these fowls were obtained from a private flock which was maintained at about 400 fowls. Each autumn the less desirable fowls were eliminated and young chicks from the retained breeders were added the following spring. The flock was divided into various groups which were tested each autumn, after the spring pullets had come into full production. All fowls that reacted to the test were removed, isolated and tested monthly to determine the consistence of their reactions. With few exceptions the tissues of all fowls that had been previously tested and had died during the course of the experiment, as well as those that were used for other purposes, were cultured for *S. pullorum*.

The tube agglutination method, or its modification in the form of the rapid slide method, was the standard technic for determining carriers of pullorum disease. These tests were run in a dilution of 1:40 and 1:80, except when it was desirable to know the maximal titre of various fowls. The antigen used was prepared according to the method recommended by Rettger and Gwatkin.[1]

In obtaining material for cultures, fowls were killed by decapitation and a sample of blood was taken and seeded on appropriate media. A portion of the liver, the spleen and the entire ovary were then removed, along with any other part which contained lesions which might be attributable to the disease, transferred to sterile mortars and macerated with sterile sand and physiologic sodium chlorid solution. The emulsions thus obtained were allowed to stand in sterile tubes until the coarser particles had settled, and then a part of the supernatant suspension was transferred to agar slants and glucose-brain broth media.

When the ovary was small and unproductive, the entire organ was macerated, but if there was macroscopic evidence of the disease, one or two of the affected follicles were used for culture. In the functioning organ the larger normal yolks were discarded and the remaining smaller ovules were used. Suspensions of the macerated organs were retained in the refrigerator after a sam-

ple was cultured and, if growth was not observed within 24 hours, the supernatant fluid of the macerated organ was centrifuged. The clear fluid was then discarded and the sediment seeded on culture media.

Twenty-four adult hens that had responded negatively to the agglutination test, after four examinations, were isolated, and after the response to the test had been negative for eight months following, twelve of the fowls were infected by feeding them the viscera of young, artificially infected chicks that had died of pullorum disease. The other twelve fowls were maintained under similar conditions as controls.

Agglutination tests were made on the controls as well as on the exposed fowls, each month for seven months after the latter had been fed the infected material. At the end of this period all were killed and the various organs were examined for evidence of the disease and cultured in the manner described.

Results

Experiment 1: In order to correlate the agglutination test with bacteriologic data, 155 fowls were tested for various lengths of time, and at necropsy, all fowls, regardless of their reaction to the agglutination test, were examined and cultures were made for *S. pullorum.*

The fowls have been considered under three groups: (1) those whose response had been consistently negative to the agglutination test; (2) those whose response had been consistently positive to the agglutination test, and (3) those in whom response had been inconsistent. This last group includes all fowls in which tests were consistently positive or negative for a time and then later gave the opposite reaction, as well as those which reacted positively the first month, negatively the second, and positively again the third. Table I contains the results of the experiment in condensed form.

Twenty-one (75 per cent) of the 28 fowls that reacted gave positive cultures of *S. pullorum,* and three gave cultures of *Eschericia coli.* In cultures of the remaining four, growth was not obtained; two of these fowls were males without lesions. There were 19 (68 per cent) whose ovaries were typically diseased and a group of five, four of which had lesions of the heart besides ovarian lesions. There were nine fowls without macroscopic evidence of the disease, yet a positive culture of *S. pullorum* was obtained from the ovary in four.

Eighty-six (98.8 per cent) of the 87 fowls that did not react were free from the disease, as the test indicated, and only one

of these gave a culture of *S. pullorum;* this fowl, however, had only one agglutination test. There were ten fowls that gave cultures of other organisms from the ovary, most of which were *Esch. coli,* and seven of these had lesions of the ovary. The lesions, however, could not be said to be typical of pullorum disease, as the ovary was not enlarged and the dark ova were not hard, although they were cystic and discolored. There were ten male fowls in this normal group.

TABLE I—*Correlation of the agglutination test with bacteriologic and pathologic data (experiment 1).*

	REACTORS	NON-REACTORS	INCONSISTENT*
Fowls	28	87	40
Positive cultures for *S. pullorum*	21	1	8
Negative cultures	4	76	22
Organisms other than *S. pullorum*	3	10	9
Lesions in the ovary	19	7	13
Extra-ovarian lesions of pullorum disease	5	0	0
No macroscopic lesions	9	80	26
Tests, one to three, inclusive	5	39	3
Tests, four to six, inclusive	10	32	23
Tests, seven to ten, inclusive	13	16	14

*The identity of one culture from this group was not determined.

The data concerning the inconsistent group are probably the most interesting of the series. According to the agglutination test, the fowls harbored an infection caused by *S. pullorum,* but were later shown by the same test to be free of infection (table II). All of these fowls were removed from the flock, as were those that gave reactions, and isolated in separate cages. Monthly tests were made after isolation. They were killed, bacteriologic cultures were made of the various organs by the routine procedure and lesions were noted. All fowls dying in the course of the experiment were handled similarly.

The results of culture in the inconsistent group show that eight (20 per cent) of the 40 fowls in the classification gave positive cultures of *S. pullorum.* Twenty-two of the group gave sterile cultures, two of which were from males. *Esch. coli* was isolated from the ovary of nine fowls, all of which manifested some abnormality of this organ. Five other fowls also had lesions in the ovary. In three fowls the lesions were typical of those induced by *S. pullorum,* but from these the organisms could not be isolated. Fourteen (35 per cent) of the entire group had

TABLE II—*A series of reactor and inconsistent birds showing relationship between repeated agglutination tests and bacteriologic data (experiment 2).*

Fowl	Agglutination Tests										Culture	Pathologic Data
	11–12–29	1–16–30	1–23–30	3– 6–30	4–5–30	5–10–30	8–16–30	9–26–30	11–20–30	1–22–31		
1	4+	4+	4+	4+	4+	4+	4+	4+	4+	4+	+	Typical lesions of the disease in ovary and heart; adhesions and egg concretions in abdominal cavity
2	4+	2+	2+	2+	1+	2+	–	–	–	–	–	Lesions of tuberculosis; ovary contained two hard follicles
3	4+	4+	4+	4+	4+	3+	4+	4+	4+	4+	+	Pericarditis, ovary contained many hard follicles
4	4+	3+	4+	2+	1+	2+	1+	–	–	–	–	Ovary small and dark, one cyst attached; lesions of tuberculosis
5	4+	4+	4+	2+	1+	1+	2+	–	–	2+		No macroscopic lesions
6	4+	4+	4+	4+	4+	3+	4+	4+	3+	3+	+	Ovary dark and hemorrhagic; no hard or misshapen ova
7	4+	4+	4+	4+	4+	4+	4+	4+	4+	3+	–	Normal ovary, producing hen; no macroscopic lesions
8			4+	4+	3+	2+	3+	4+	2+	2+	–	Ovary clear and functioning; no lesions
9			4+	4+	4+		4+	4+	4+	4+	+	Lesions in the ovary; no other macroscopic lesions
10	4+	4+	4+	2+	4+	2+	4+	4+	3+	1+	+	Nonproducing hen; ovary presented typical lesions of the disease
11	4+	4+	4+	4+	4+	4+	4+	4+	4+	4+	+	Lesions of pullorum disease found only in ovary
12	4+	3+	4+	4+	4+	4+	4+	4+	4+	4+	+	Necrotic area on the heart; ovary contained many misshapen ova
13	–	–	–	4+	4+	4+	4+	4+	4+	4+	+	Typical lesions in the ovary
14	4+	4+	4+	4+	4+	4+					+	Ovary presented typical lesions
15	2+	4+	4+	4+	4+	3+	1+	1+	–	–	–	Normal ovary
16	4+	4+	4+	4+	4+	4+	4+	4+	4+	4+	+	Ovary clear; slight pericarditis
17	4+	3+	4+	2+	2+	1+	1+	–	–	–	–	Testes atrophied; no other lesions
18	–		4+	2+	2+	1+	–	–	–	3+	–	Atrophic testis
19	2+	3+		2+	2+	1+	–	–	–	1+		Ovary contained two dark follicles
20	4+	4+	4+	4+	4+	4+	4+	4+	4+	4+	+	Ovary contained many misshapen ova; severe pericarditis
21	3+	3+	2+	2+	2+	–	2+	1+	1+	–	–	No lesions
22	3+	1+	4+	1+	2+	1+	–	–			–	Male; no lesions

abnormal ovaries and eight of these gave positive cultures of *S. pullorum*.

Two of the fowls (table II) harbored the infection, according to the agglutination test, yet the ovary was functioning and clear and all cultures of liver, spleen, heart and ovary were negative for *S. pullorum*. Certain others, as indicated by the agglutination test (table II), had recovered from the disease. The lesions persisted, however, but when cultured no viable organisms were recovered.

Experiment 2: Twelve adult fowls were fed the viscera of chicks that had died from pullorum disease and an equal number of adult fowls were held as controls. The tests on these birds were made by the rapid slide agglutination method except where otherwise specified. Each bird was tested five times before being exposed to the infection, and on two separate dates the same serums were run by the tube agglutination method in dilutions of 1:25, 1:50, and 1:100, in conjunction with the macroscopic slide method. Each fowl to be infected then was fed the viscera of three infected chicks for three consecutive weeks, the viscera from one chick being used each week. Table III shows that in all but one fowl thus exposed a positive titre developed within four weeks. Such a titre was not observed in one fowl until two months after the feeding. Ten of the twelve birds gave positive cultures from the ovary eight months later, and all but one of these had lesions of the disease in the ovary. This one, however, had an active infection in the ovary, as evidenced by a positive culture of *S. pullorum* from that organ. Low titres developed in two fowls (table III) for a period of two months, but evidently they recovered as the tests became negative. The infection did not become localized in either of these fowls, as lesions were not present at the time of death and the cultures remained sterile.

The ovarian lesions found in the artificially infected fowls were different from those spontaneously infected on which necropsy was performed. The ovary from the artificially infected fowls did not contain the extremely hard retained ova that are so typical of the disease, but the ova contained semi-solid material and had the appearance of a partially resorbed yolk. The ova in the artificially infected hens were misshapen and irregular in size, but were yellow instead of brown or black as found in fowls that had been carrying the infection for a longer period. The lesions of the artificially infected ovaries

TABLE III—*Results of feeding infected viscera (experiment 2).*

Fowl*	Agglutination Tests										Pullorin Reaction 24-hour	Pullorin Reaction 48-hour	Culture	Lesions
	9-15-29	2-27-30	3-18-30	5- 3-30	6-15-30	7-29-30	8- 7-30	8-27-30	9-26-30	11- 5-30	12- 8-30	1-23-31	2-10-31	
23	+					4+	4+	4+	4+	4+	4+	4+	4+	+
24						4+	4+	4+	4+	K	4+	4+	4+	+
25						4+	4+	4+	4+	4+	4+	4+	4+	+
26						4+	4+	4+	4+	4+	4+	4+	4+	+
27						–	–	4+	4+	4+	4+	4+	4+	+
28						4+	4+	3+	4+	4+	4+	4+	4+	+
29						4+	4+	4+	4+	4+	4+	4+	4+	+
30						2+	3+	4+	3+	1+	1+	2+	4+	+
31						2+	1+	–	–	–	–	–	–	+
32						4+	4+	4+	4+	D	–	–	–	+
33						2+	2+	2+	–	–	–	4+	4+	+
13						4+	4+	4+	4+	4+	4+	4+	4+	+
34						–	–	–	–	–	–	–		–
35						–	–	–	–	–	–	–		–
36						–	–	–	–	–	–	–		–
37						–	–	–	–	–	–	–		–
38						–	–	–	D†	–	–	–		–
39						–	–	–	–	–	–	–		–
40						–	–	–	–	–	–	–		–
41						–	–	–	–	–	–	–		–
42						–	–	–	–	–	–	–		–
43						–	–	–	–	–	D‡	–		–
44						D§	–	–	–	–	–	–		–

K=killed. D=dead.
*Fowls 23 to 33, inclusive, and 13 fed infected viscera. Fowls 34 to 44, inclusive, served as controls.
†Dead 8-30-30. ‡Dead 12-13-30. §Dead 7-5-30.

may be interpreted as the results of recent infection. The ova, therefore, had undergone only partial degeneration.

In striking contrast to the results described, all the fowls of the control group gave consistently negative results to all agglutination tests, and at necropsy all cultures were negative for *S. pullorum*. The ovaries were normal as far as could be determined macroscopically.

Just before the experiment was to be terminated, the infected fowls as well as the controls were subjected to the pullorin test. The pullorin used was a cellular, commercial variety and was injected intradermally into the wattle (table III). The reactions, read at 24 and 48 hours after injection, show that in the case of the group of negative fowls they were non-specific. The group, however, is too small definitely to appraise the reliability of this test.

COMMENT

The percentage of cases in which the agglutination test for pullorum disease is supported by positive cultures of the organism is somewhat variable. Newsom and his collaborators[2] reported 92 per cent agreement; Edwards and Hull,[3] 90 per cent; Kernkamp,[4] 65 per cent; Jones,[5] 87 per cent, whereas my data show agreement in 75 per cent of the cases. Although the authors mentioned did not state the results of culturing other organs, their data show a variation of from 8 to 35 per cent of fowls consistently positive to the agglutination tests which did not harbor the organism in the ovary. The hypothesis has been advanced that this group of fowls harbors a focus of infection in some other part of the body, yet cultures of portions of the liver and spleen, as presented here, have failed to show a single instance in which *S. pullorum* was recovered from either of these organs when it was not recovered from the ovary.

The fowls classified as inconsistent to the test constitute a more serious problem. Twenty per cent of this group gave positive cultures of *S. pullorum;* 35 per cent had ovarian lesions and 22.2 per cent gave cultures or organisms other than *S. pullorum,* most of which were *Esch. coli.* Some of the fowls in this group undoubtedly had recovered from the disease, as shown by the steadily diminishing titre of the blood serum (table III). In spite of the fact that the lesions still persisted in two of these cases, the organism could not be isolated. When it is considered that even dead organisms or their products are capable of producing agglutinins in the blood-stream, the absence of a positive

serum titre together with negative cultures is presumptive evidence that these fowls had overcome the infection.

Inconsistent reactions are noticed more frequently in male fowls and in fowls in which the disease is spreading. It is probable that fowls in this classification become repeatedly infected, yet resist localization of the organisms and consequently react negatively on culture. It should be emphasized also that the blood of many of the fowls agglutinates only in low dilutions or induces a suspicious reaction, and that these fowls should not be classified as those that reacted because it is known that closely allied members of the colon and paracolon groups of organisms will agglutinate *S. pullorum* in dilutions of 1:20 or higher. Cultures of such organisms were recovered from 22.2 per cent of this inconsistent group.

The so-called inconsistencies of the agglutination test for pullorum disease should not be taken as a serious objection to the test as a diagnostic method, since only a small percentage of fowls reacting in higher dilutions give negative cultures. Furthermore, if correctly applied, the test is probably much superior and more sensitive in detecting the infection in fowls than any culture method thus far devised. The culture method, which investigators have accepted as the final proof of infection by *S. pullorum* and which has been used in determining the accuracy of the agglutination test, is inadequate, since it is impractical to culture all tissues and it is not applicable to the living fowl.

Only one of the 87 fowls that reacted negatively to the agglutination test gave a positive culture of *S. pullorum*, and it is highly probable that they became infected at the time of or shortly after the last test. Seven of the fowls reacted negatively as well as 14 of the inconsistent group in which the ovary was somewhat diseased. This would tend to show that all lesions of that organ, such as dark and discolored ova or partly resorbed yolks, are not pathognomonic of the disease. One fowl in which the serum titre was high for fourteen months had a normal appearing ovary, yet pure cultures of the organism were recovered from that organ at necropsy.

The site of the focus of infection among male fowls has at times been found in the testis or the pericardial sac. In the series of fowls studied, male birds that gave reactions when isolated were found to recover gradually from the disease or become extremely erratic in their reactions to the test. Cultures taken of the testes of male birds that gave reactions often contained pure cultures of staphylococci but never contained *S. pullorum*.

which is in agreement with the results of Kernkamp,[4] who was also unable to recover *S. pullorum* from infected male fowls. It is probable that the infection does not often become localized in male fowls, but the external genitalia, which become infected by coming in contact with infected hens, may be the source of the infection which is aggravated or activated by coition. The disease is then overcome or aborted by the males after they are isolated so that they gradually become negative to the agglutination test.

The data presented in the second experiment show that a positive titre to the agglutination test can be developed by feeding susceptible fowls live cultures of the organisms. These data show also that, after *S. pullorum* has been ingested by fowls, it has a very definite predilection for the ovary. In 83.3 per cent of the fowls eating the organism the disease was definitely localized in the ovary to the extent that the organ presented macroscopic lesions, and in each case *S. pullorum* was isolated. These experiments lend further confirmation to the belief that certain fowls (table III) may become infected and show a positive reaction to the agglutination test, but later give negative reactions and at necropsy be without macroscopic or cultural evidence of the disease. This evidence might suggest that immunity to the disease is not developed by fowls, since specific agglutinins do not seem to be retained within the blood-stream after they recover from the infection.

The control group of fowls was negative to all agglutination tests during the entire course of the experiment, and when necropsy was performed they were found to be free of the disease culturally and pathologically.

When the pullorin test was administered to the group of artificially infected fowls and controls, it was found to be nonspecific in the reaction because there was swelling of the wattle in six of the nine control fowls which were given injections. The swelling or edema was interpreted as a reaction of a diseased fowl, but these six hens which were negative to the agglutination test were found at necropsy to be without lesions, and cultures were negative for *S. pullorum*. This was in agreement with agglutination tests.

Summary and Conclusions

Additional data have been presented on pullorum disease in adult fowls. A series of 996 fowls were tested by the agglutination method for varying periods. Necropsy was performed on

155 fowls, lesions were noted, and the ovary and various portions of the liver and spleen were cultured. Susceptible fowls, negative to the agglutination test, were fed with the viscera of small chicks dying from pullorum disease. It was found that the agglutination test is confirmed by bacteriologic cultures in 75 per cent of all adult hens reacting consistently to the agglutination test. From these data it may be concluded:

1. The agglutination test is probably more accurate in detecting infections of pullorum disease than any method that depends on isolation of the organism from infected birds.

2. Lesions in the ovary do not mean that a hen is necessarily affected with or is a carrier of pullorum disease; the lesions may have been produced by means other than *Salmonella pullorum*.

3. A reaction to the agglutination test for pullorum disease is evidence of an existing infection with *Salmonella pullorum* and is not necessarily an immunologic reaction.

4. Birds may recover from the disease and show no evidence of immunity by agglutinins in the blood-serum.

5. In a high percentage of fowls that have been fed the organism, infection in the ovary becomes localized.

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Tuberculosis Death Rate Down

A statistical survey of pulmonary tuberculosis in 59 American cities, made by Dr. Frederick Hoffman, shows the death rate from that disease in those cities to have been reduced from 174.4 per 100,000 of population in 1910 to 63.2 in 1931, or almost a two-thirds reduction. It is interesting to compare these figures with those for cattle condemned for bovine tuberculosis under the tuberculosis eradication plan. In 1920, 4.1 per cent of the cattle tested were found to be reactors; in 1931, only 1.5 per cent reacted. Again the reduction is approximately two-thirds.

EFFECT OF TRYPAN BLUE, THIONIN AND PYRONIN ON THE AGGLUTINATION TITRE OF COWS INFECTED WITH BANG'S DISEASE*

By E. E. SLATTER *and* ROBERT GRAHAM
Laboratory of Animal Pathology and Hygiene
University of Illinois, Urbana, Illinois

A few years past, certain antiseptics commonly were administered to cattle to effect a cure of Bang's disease. Such antiseptics as phenol and methylene blue were among the first presumed to possess specific curative properties for Bang's disease, while innumerable empirical remedies with closed formulas were at one time advertised in farm papers. The unproven claims of specificity frequently were presented on the basis of clinical observations. Many such remedies, once advocated for the cure of Bang's disease, have been eliminated from channels of trade by the Food and Drug Division of the federal Department of Agriculture, yet a variety of antiseptics are employed by veterinarians from time to time in a clinical fashion to effect a cure of the disease in different herds.

Notwithstanding the dearth of reliable data in support of specific treatment, the "cure" approach of Bang's disease in cattle has an appeal for many stockmen and veterinarians. The possibility of finding a specific remedy also has prompted investigations in the therapy of Bang's disease and many veterinary practitioners hopefully look forward to the time when an effective remedy may be found.

Antiseptics mentioned in recent years for the treatment of Bang's disease include acriflavine, trypacrin "A," tryparsamide, colloidal carbon, metaphen, and an iodin preparation known as alkali hypoiodite. No one would care to question the economic advantages of a proven remedy. However, in herds where antiseptics of reputed merit have been employed, as well as bacterins and vaccines, little or no effort has been made to note the agglutinin titre of treated animals. In order to obtain information on this subject, preliminary treatment of reactors was undertaken at the Illinois Experiment Station.[1-4] The antiseptics were administered according to procedures which were reported to have given favorable results in other hands. Following treatment, the blood sera of the animals were tested for Brucella agglutinins over a period of eight to ten months. Acriflavine, trypacrin "A" and colloidal carbon, administered intravenously,

*Received for publication, June 17, 1932.

as well as alkali hypoiodite given intramuscularly, apparently did not influence the agglutinin titre of the treated animals under our observations. Similar results were obtained following the injection of *Brucella abortus* bacterins intravenously.

More recently Schubert[5] reported favorably on the chemotherapy of trypan blue* for Bang's disease. The deductions were made on a clinical basis yet, according to Schubert, it appeared that the animals might be greatly benefited by repeated intramuscular injections of this dye. To determine the effect of trypan blue on the Brucella agglutinin titre of cows at the Illinois Experiment Station, a group of six known reacting cows, varying in age from six to eleven years, were given trypan blue in the amounts employed by Schubert. Three consecutive monthly tests, preceding treatment, showed that all animals were consistently positive to Brucella antigen in dilutions of 1:200 or higher. The milk sera of these animals showed a titre which varied from 1:50 to 1:200, and gave a less constant reaction than the blood sera. The previous history of the animals in this group showed that one had aborted three times, one twice, and one once. Three had never aborted, but had reacted positively to the agglutination test.

The trypan blue treatment consisted of three injections of 100 cc of trypan blue (1 per cent solution) into the neck muscles at intervals of 21 and 60 days, respectively. Following treatment, nine consecutive monthly agglutination tests for Bang's disease were made on the blood sera and milk of the six cows. No appreciable change in agglutinin titre was noted. Five cows of this group calved normally during this period and one failed to conceive.

In view of the inhibiting action of thionin and pyronin† on *Br. abortus* and *Br. suis*,[6,7] two groups of six animals each, aged five to thirteen years, were injected intravenously with thionin and pyronin, respectively. Preceding the initial injection, three monthly agglutination tests showed titres of 1:200 in the blood sera of the twelve animals. Milk samples from three animals were negative in the pre-treatment agglutination tests, while samples from the remaining nine cows showed titres varying from 1:50 to 1:200. Previous to the treatment, one animal had aborted three times, one had aborted twice, and three had aborted

*Trypan blue—a sodium salt of tolidin-diazo-diamino-naphthol-disulphonic acid.

†Thionin—a dye of the thiazine series, Lauth's violet, $C_{12}H_9N_3S$. Pyronin—a formo-rhodamine hydrochlorid.

once. Seven of the group of twelve reactors had calved normally.

Each animal in one group received six 1-gram doses of thionin, and each animal in the other group was given similar doses of pyronin, at intervals of three to four days. For eight months following the treatment, the agglutinin titre of the blood sera remained practically the same as before the treatment. Milk sera from all twelve animals gave rather inconstant positive reactions. In the pyronin group, one animal that had aborted two times previous to the treatment, as well as two that had calved normally before, aborted during the latter part of this experiment at three, five and nine months after the last treatment.

SUMMARY

Three groups of six animals each, positive to the agglutination test for Bang's disease, continued to show titres of 1:50 to 1:200 for eight months after treatment with trypan blue, thionin and pyronin, respectively. No evidence was obtained to suggest that trypan blue, thionin or pyronin altered the agglutinin titre of the blood or milk sera of the treated animals.

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Dog and Cat Get $20,000

Red and Peanuts, a shepherd dog and a cat, are beneficiaries of a $20,000 trust fund, created by the will of Mrs. Alice Hunter, of Chicago, to provide them with food and shelter for the rest of their lives. When these legatees quarrel, at least it won't be over the division of their inheritance. After their death, the principal will be distributed equally among the Anti-Cruelty Society, the dog refuge "Orphans of the Storm," and the Home for Destitute and Crippled Children.

STUDIES IN INFECTIOUS ENTERITIS OF SWINE
VII. Studies on the Use of Colloidal Iodin in Swine Coccidiosis*

By H. E. BIESTER *and* CHAS. MURRAY

Department of Veterinary Investigation
Iowa State College, Ames, Iowa

During the past few years considerable interest has been evidenced by veterinarians with regard to the anthelmintic properties of colloidal iodin preparations. Likewise the question of its value as a protozoacide has been raised.

Studies conducted on swine coccidiosis in this institution have given rise to considerable data on the course and duration of experimental coccidial infections in swine, particularly with reference to the elimination of oöcysts.[1] With these as a basis, it was believed possible to determine quite accurately the degree of inhibitory action of colloidal iodin, if any, upon the course of such infection in swine.

DISCUSSION OF DOSAGE

With no available data concerning dosage for swine, some experiments were conducted first to determine their tolerance for colloidal iodin. The dose recommended for older chickens is one ounce. Assuming the average weight of such birds to be about five pounds, it was estimated that a dose of 6 cc per pound of body weight might be proper for swine. A pig not infected with round-worms or coccidia tolerated this dose (6 cc per pound of body weight) quite well, while a dose of 13 cc per pound of body weight almost proved fatal. For this reason it was tentatively planned to allow 6 cc per pound of body weight in cases in which one administration was to be made, and 3 or 4 cc in repeated administration. It was found, however, that when coccidial cultures were given, the pigs did not tolerate the iodin preparation so well as non-infected pigs. Even when held off feed 12 to 24 hours, most of them vomited portions of the iodin.

While a 48-pound pig tolerated a dosage of 6 cc per pound of body weight without manifesting clinical symptoms, it was found that pigs above 80 to 90 pounds do not tolerate similar doses so well. A 75-pound noninfected boar, fed 300 cc of colloidal iodin (4 cc per pound of body weight), presented some gastric mucosal hemorrhage, colored brownish red. Considerable mucous exudate

*Received for publication, July 27, 1932.

was found on the surface. The mucosa was separated from the muscular coats by a pronounced submucosal edema.

A boar weighing 105 pounds, that received 525 cc (5 cc per pound of body weight) 24 hours later, showed a very severe, extensive, hemorrhagic and necrotic gastric mucosa. The mucosa also was separated from the muscular coats by a zone of severe inflammatory edema, involving the submucosa, which was more than one-fourth inch thick and of a gelatinous consistency.

These facts, together with the clinical condition of the smaller pigs fed 4 to 6 cc of colloidal iodin per pound of body weight for the first time, following the ingestion of infective coccidial oöcysts, would seem to indicate that a maximal dose had been reached for infected pigs. Incidentally, the administration of such a quantity at present prices makes its use prohibitive in swine practice, from the standpoint of cost.

Fourteen pigs, averaging about 65 pounds, were placed in individual pens. Following a short quarantine period, fecal samples taken from all pigs were negative for coccidial oöcysts for seven days. On the seventh day each pig was given, per os, composite suspensions of 3,290,000 sporulated *Eimeria debliecki* and *Eimeria scabra*. Seven of these pigs (see chart 1A) were given a colloidal iodin preparation, while the remaining seven were left untreated. The iodin preparation was administered by means of a rubber tube passed into the stomach through a smooth, nickel-plated pipe that served as a speculum. A funnel was attached to one end of the rubber tubing. Of the treated group, three pigs (3926, 3911 and 3913) were given 5 cc of the iodin preparation per pound of body weight on the eleventh day of the experiment, *i. e.*, four days following the feeding of sporulated oöcysts. On the thirteenth day, this treatment was repeated in the same three pigs. Newly-formed oöcysts began to appear in the feces of both treated and untreated groups on the thirteenth day. On the fourteenth day, pigs 3926, 3911 and 3913 again were fed 5 cc of the iodin preparation per pound of body weight and the remaining four pigs of this group (3915, 3916, 3917 and 3918) were fed each a dose of 6 cc per pound of body weight. On the seventeenth day, at which time the peak of the oöcyst-elimination curve was reached, all pigs previously given iodin again were fed 2 cc of the iodin preparation per pound of body weight.

The elimination of newly-formed oöcysts, *i. e.*, oöcysts produced as a result of the infection, is expressed by the average number of oöcysts present in ten low-power fields. It will be

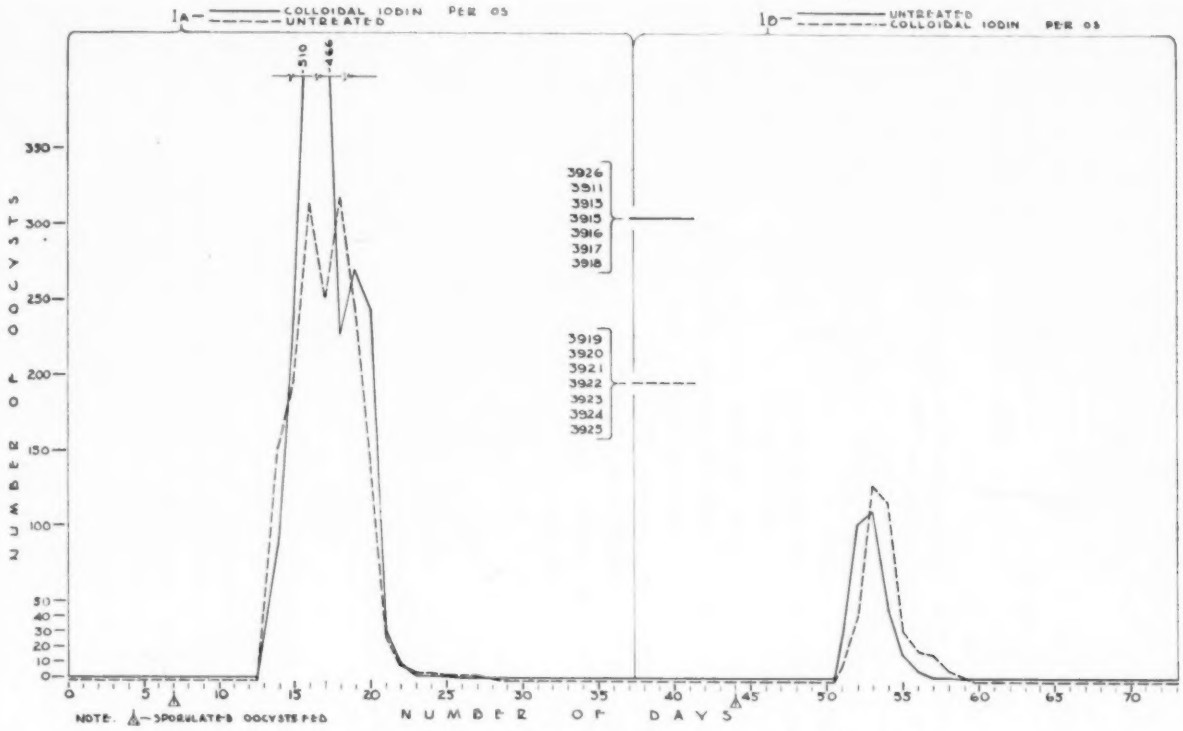

FIG. 1. Charts showing effect of colloidal iodin on oöcyst elimination.

noted from chart 1A that oöcyst-elimination was not inhibited by the iodin treatment. On several days the oöcyst-elimination of the treated group was even higher than that of the untreated group. Also, of great significance is the fact that the period of duration of the oöcyst-elimination is the same in both treated and untreated groups. Thus it is shown that the iodin treatment neither exerted any inhibitory action on the coccidia nor interfered with the life cycle.

The newly-formed oöcysts recovered from the iodin-treated group were viable and sporulated as well as those obtained from the group not treated with the iodin preparation. A slight lag in oöcyst-elimination appears in the treated group for the first two days as well as at the end of the elimination period as compared with the untreated group. This no doubt was due to interference with peristalsis caused by the iodin administration, as noted in the descriptions that precede. As a check against the possibility of any striking variation in susceptibility between the treated and untreated groups, it was decided to allow a rest period following the first trial, after which iodin treatment was planned for the previously untreated group.

Accordingly, on the 44th day of the experiment, after both groups had been negative for fifteen days, each pig was fed a suspension of 10,000,000 sporulated oöcysts containing both *E. debliecki* and *E. scabra* (chart 1B). Pigs 3926, 3911, 3913, 3915, 3916, 3917 and 3918, which received colloidal iodin in the first phase of the investigation, received none at this time, while the previously untreated groups (pigs 3919, 3920, 3921, 3922, 3923, 3924 and 3925) (chart 1B) were given colloidal iodin during the second half of the experiment. In view of the negative results obtained in the first trial, iodin treatment was begun earlier and repeated more often.

On the 45th day (24 hours after the administration of the infective forms), each pig of the group to be treated was given 4 cc of colloidal iodin per pound of body weight. On the 48th day of the experiment, each was given an additional 3 cc per pound of body weight. On the 51st day, iodin treatment was repeated in dosage of 4 cc per pound of body weight. Again, on the 55th day, 3 cc per pound of body weight was administered.

The elimination of oöcysts in both treated and untreated groups was lower because of the increased resistance produced by the first infection.[1] In spite of the large repeated doses of the iodin preparation throughout the second half of the experiment, the treated group eliminated equal or greater numbers of viable

oöcysts as compared with the untreated group. As in the first trial, the iodin-treated group in this instance showed a lag in the period of elimination, both in the beginning and at the close (chart 1B). As in the first half of the experiment, this lag in oöcyst-elimination was attributed to the interference with peristalsis, probably being more pronounced in the second infection because of the more frequent iodin administrations and the resulting diminished appetite. However, the duration of the oöcyst-elimination period was neither shortened nor otherwise influenced by the treatment.

During the first 42 days of the experiment, the group receiving iodin gained 53 pounds, while the untreated group gained 68. Neither group made normal gains since they were confined indoors and passed through a coccidial infection during this period.

In addition to determining the number of coccidia present on the basis of our standard (forms per low-power field), we also recorded the ascaris ova found, the numbers indicating that colloidal iodin exerts a slight anthelmintic action towards the common roundworm in swine, with the large, repeated doses. The subjects that were sacrificed at the close of the experiment harbored varying numbers of ascaris.

CONCLUSIONS

Colloidal iodin, in large repeated administrations, did not in any way influence the course of controlled coccidial infections in swine. A slight anthelmintic action against round-worms, following large, repeated doses, might be attributed to it.

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Ask Damages for Trichinosis

Aftermath of a serious outbreak of trichinosis in Portland, Ore., reported by Dr. E. E. Chase, in the November, 1932, issue of the JOURNAL, is a damage suit aggregating $160,000, filed by seven persons against a local sausage-plant from which trichinae-infected salami is alleged to have come. The seven plaintiffs charge that on August 13, 1932, they were sold salami sausage infected with trichinae and that they were made ill by eating it. Various amounts, ranging from $15,000 to $50,000, make up the $160,000 total.

THE WHOLE-BLOOD, STAINED-ANTIGEN AGGLUTINATION TEST FOR PULLORUM DISEASE*

By E. H. BARGER *and* J. P. TORREY,
State Department of Agriculture
Laboratory of Animal Pathology and Hygiene
University of Illinois, Urbana, Illinois

The standard tube agglutination method has repeatedly proved of value to flock-owners in the suppression of pullorum disease. However, in testing large numbers of fowls, the details involved in collecting and submitting properly labeled blood samples to a laboratory have proved laborious and time-consuming. For many years a dependable test, requiring less time and fewer technical details, has been sought to aid the poultrymen, veterinarians and live stock sanitary officials in the suppression of pullorum disease.

Since the whole-blood, stained-antigen agglutination test for pullorum disease was described by Bunyea and coworkers,[1] of the federal Bureau of Animal Industry, and by Coburn and Stafseth,[2] of Michigan State College, many Illinois flock-owners and hatcherymen have shown an increased interest in the systematic testing of their flocks by this method. At the Illinois Experiment Station, a preliminary study of parallel tests with the tube and the whole-blood, stained-antigen methods has given results that show an encouraging correlation but also emphasize the importance of factors which may reduce the efficiency of the whole-blood test.

In untrained hands the whole-blood agglutination test is unreliable. However, with an improved technic, the disagreement between the whole-blood and the standard tube tests appears insignificant. Using the tube test as an arbitrary standard of perfection in the detection of reactor fowls, the whole-blood agglutination test has approached an efficiency of nearly 100 per cent in the routine testing of farm flocks. Such factors as constant temperature, proper light, suitable equipment to keep out dust, as well as the skill of the operator, influence the accuracy of the test. The influence of the equipment may be reduced to a minimum by a specially constructed box which can be built at a nominal cost (figs. 1 and 2).†

The advantages of the whole-blood test compared with the tube and other methods of testing for pullorum disease are apparent,

*Received for publication, July 28, 1932.

†Dr. O. T. Hayer, Special Agent, State Department of Agriculture, devised the test-box used in initial field tests. The modifications herein described include changes which have proved of value.

FIG. 1. BOX FOR STAINED-ANTIGEN, WHOLE-BLOOD TEST

The wooden box has proved satisfactory for one person to operate. It can be constructed at a nominal sum. A handle on the front permits the box to be carried with ease. Properly identified slides on which the blood and antigen are mixed are placed in the trays, which are situated directly beneath the glass plate. The glass plate protects the samples from dust and rapid drying. Trays fit snugly into the box and reduce air currents. When the samples are ready to be read, the trays may be removed and a careful examination of slides made. There is room for six slides in a tray. Several tests may be under way in the slide trays at the same time.

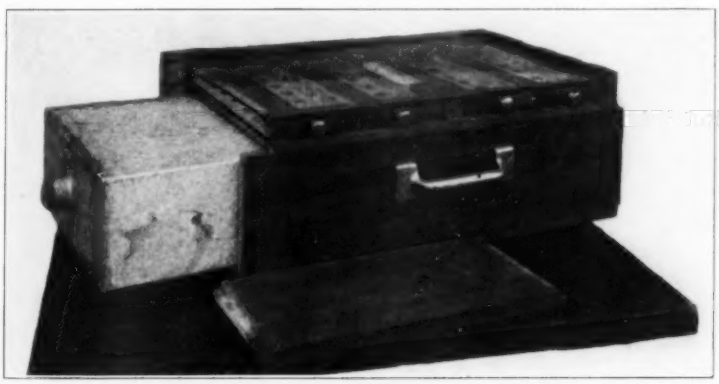


FIG. 2. ARTIFICIAL HEAT FOR STAINED-ANTIGEN TEST

The heating unit consists of a water-tank which is placed in the lower compartment of the box. The glass cover and the end of the box are removed, permitting the tank to be withdrawn. Hot water is added through the opening in the end of the tank. The operator can regulate the temperature properly by consulting the thermometer on the top of the box. The weather has a bearing on the temperature of the water used.

provided the test is properly conducted and interpreted, and a reliable, titrated antigen is used. The whole-blood, stained-antigen method has the advantage of being more quickly dispatched and is less expensive than other methods. Fowls may be tested in from one-half minute to three minutes and, dependent upon the results, replaced in or removed from the flock with a single handling. The necessity of collecting and sending samples to a

FIG. 3. COLLAPSIBLE TABLE FOR STAINED-ANTIGEN TEST
A table with adjustable legs is convenient for holding the testing-box. Sufficient table space is available for the materials employed in the test.

laboratory and handling the fowls a second time, as in routine tube testing, is eliminated.

Equipment for the Test

The following equipment has been employed in preliminary tests conducted on farm flocks by the Illinois Experiment Station:

1. Testing-box.
2. Stained, titrated antigen.
3. Blunt-pointed, sharp scissors.
4. Clean microscope slides.
5. Toothpicks.
6. Paper and pencil for recording results.
7. Container for used slides.
8. Clean towels.

Various types of testing-boxes may be employed in the whole-blood, stained-antigen test. The antigen, slides, toothpicks, pencil and paper may be conveniently placed on the shelves of the box when conducting the test (fig. 3).

Procedure of Applying the Test

At least three helpers are needed by the veterinarian to carry out the test in the average farm flock. Leg- or wing-band num-

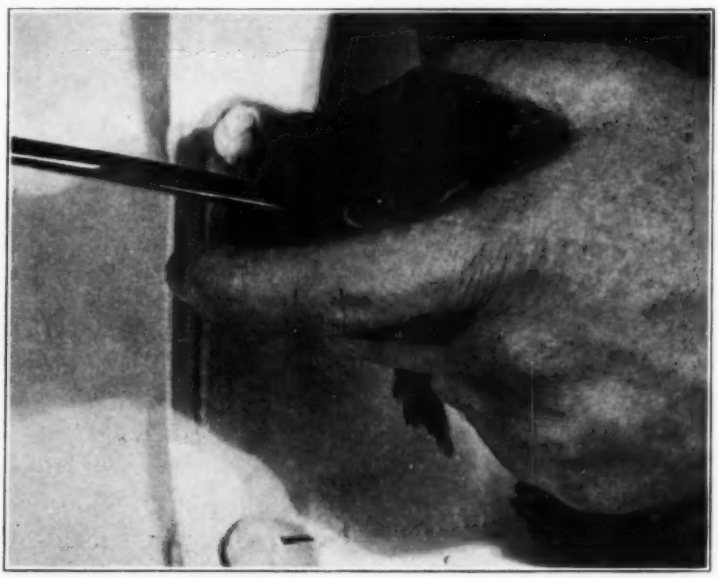


Fig. 4. Sharp, Blunt-Pointed Scissors for Snipping Comb

The fowl is held in left hand and comb snipped to obtain drop of blood. One large or two small drops are sufficient for the test. If hemorrhage persists, tincture of chlorid of iron or cautery may be used to stop the flow of blood.

bers, as well as results of tests, should be recorded by the veterinarian to avoid errors in the records. The flock-owner and his assistants should handle the chickens and draw the blood samples, placing a drop on the slide in accordance with the instructions of the veterinarian. The drop of blood is obtained by snipping the comb with a pair of sharp scissors (fig. 4). The fowl is held with the left arm, and the head is grasped firmly, the thumb and index finger being placed on the top of the head and the second finger under the throat. This method of holding permits the head to be rotated readily. The comb is then snipped and the head turned to one side so that a drop of blood may fall on the center of the slide (fig. 5). If the chicken has a single, well developed comb, the end of a point may be snipped. Small combs or rose combs may be snipped anteriorly just above the beak. As soon as the drop of blood is collected, the slide should be handed promptly to the veterinarian, who, by means of a dropper, places an approximately equal amount of stained antigen adjacent to the drop of blood and then thoroughly mixes the two with a clean toothpick (figs. 6 and 7). The necessity of prevent-

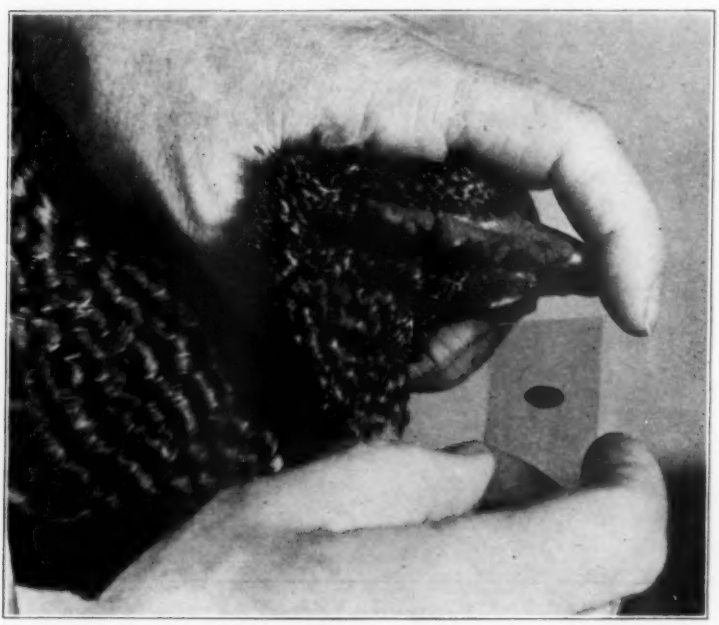


FIG. 5. SINGLE DROP OF BLOOD ON MICROSCOPE SLIDE
The head is turned and a drop of fresh blood is placed in the center of the slide.

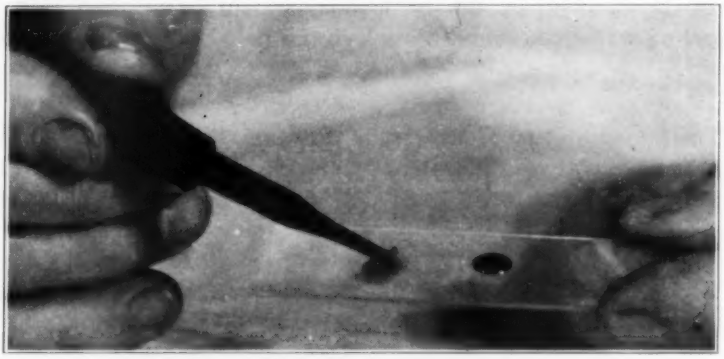


FIG. 6. SINGLE DROP OF ANTIGEN ADDED
An amount of antigen corresponding to that of the blood is placed adjacent thereto.

ing the tip of the antigen-dropper from touching the drop of blood is obvious. Difficulty may be experienced with an occasional sample which may become gelatinous and fail to mix evenly with the antigen. Such a specimen should be discarded and another sample collected. The slide holding the mixed antigen and whole blood is then promptly placed in the slide-tray of the box. A temperature of about 25° C. in the box has been found most satisfactory. Higher temperatures cause rapid drying and make reading of the results difficult and unreliable. Frequent rotation of the entire tray, after it is filled with blood samples, hastens agglutination and gives a more definite reaction. After the re-

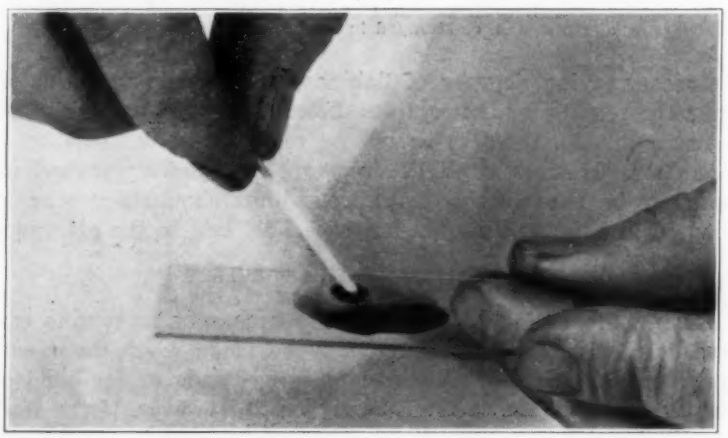
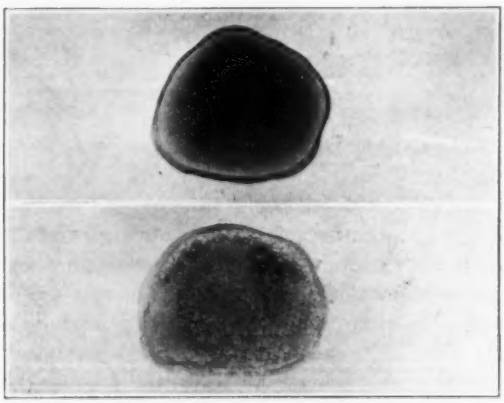


FIG. 7. ANTIGEN AND BLOOD THOROUGHLY MIXED
A clean toothpick should be used for mixing each sample.

sults are determined, the used slides should be dropped into a vessel of water, thoroughly washed and dried before being used again.

INTERPRETATION OF RESULTS

The interpretation of the test is very important (figs. 8 and 9). Distinctly positive or negative samples are easily read, but the doubtful ones may offer some difficulty. Very fine flocculation,



FIGS. 8 AND 9. READING THE TEST

Upper slide shows negative test. If the mixture of blood and antigen remains homogenous and shows no clumping, the test is negative. The slide should be carefully rotated in proper light in order not to overlook a positive reaction.

Lower slide shows positive test. The test is positive and indicates that the fowl should be removed from the flock if the stained antigen is agglutinated, or clumped in small particles.

ropiness, varying degrees of flakiness and pseudo-agglutination make the reading of the samples difficult. If good artificial light is not available, the test should be read near a window or an open door. If direct sunlight shines into the poultry-house, samples may be read in this light. Readings should never be attempted in a dark poultry-house, especially late in the afternoon.

RESTRAINING FOWLS FOR TEST

During the period of the test it is necessary to confine each fowl so that proper disposition may be made when the results are known. In flocks identified by wing-bands or leg-bands, a simple crate will suffice for this purpose. However, if the fowls are not banded, a table with wooden restraining-blocks at each side for holding the fowls will be found useful (figs. 10 and 11).

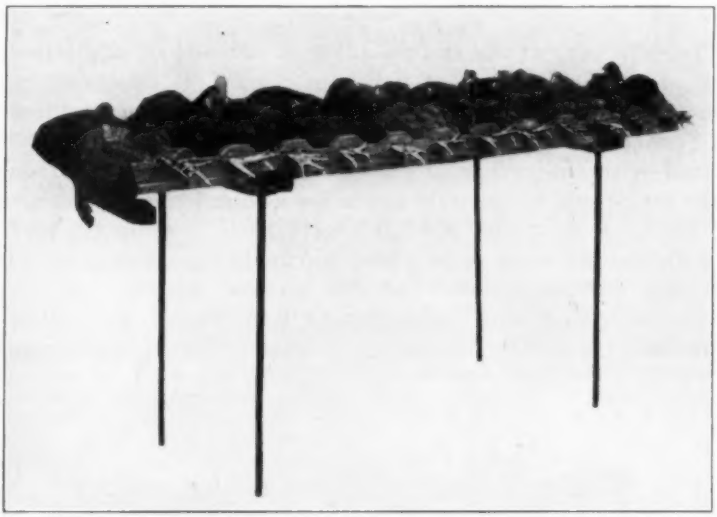


FIG. 10. TABLE FOR IDENTIFYING AND RESTRAINING FOWLS

Many fowls in farm flocks are not leg- or wing-banded, making it necessary to maintain the identity of fowls until the test is complete. Even though the fowls are leg- or wing-banded, the use of table with holding-blocks expedites the test. The position of the fowl on the table identifies it with the blood-sample number on the slide. When the test is complete, the positive reactors may be removed from table and placed in crate to go to market, while the fowls giving negative reactions are released.

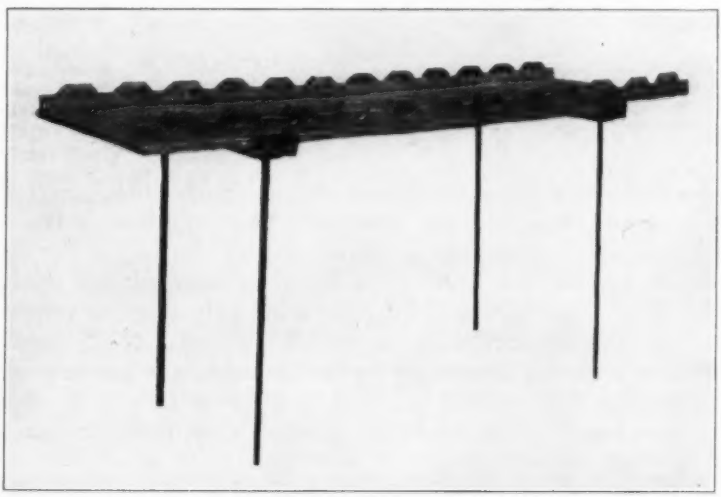


FIG. 11. TABLE WITH FOWLS REMOVED, SHOWING HOLDING-BLOCKS

The table has twelve holding-blocks on each side, used in restraining fowls until test is complete. Since there are six slides in each of the trays in the testing-box, the table is constructed in sections to hold six chickens on each or twelve on a side.

SUMMARY

The efficiency of the stained-antigen, whole-blood agglutination test, for the diagnosis of pullorum disease, is dependent upon many factors. A thorough understanding of the essential technic is fundamental. The antigen must be titrated accurately and mixed with the proper amount of fresh blood. The surroundings under which the tests are made also influence the accuracy of the results. Ample light is necessary in reading the results. Artificial light must be provided on cloudy days and at all times in dark poultry-houses. For this purpose, electric light from batteries or a common flashlight may be employed. Partial, flaky, or pseudo-reactions must not be confused with true agglutination.

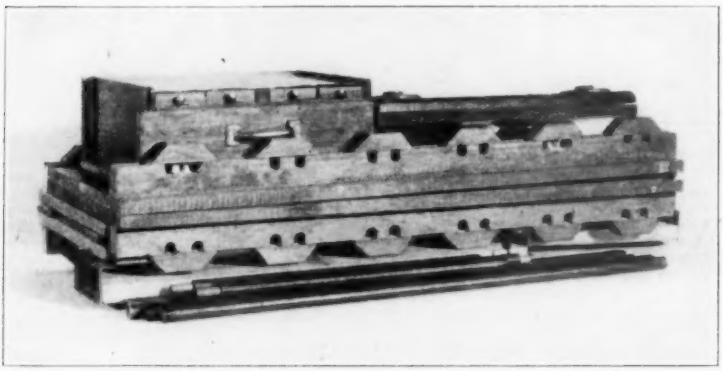


FIG. 12. EQUIPMENT DISASSEMBLED

The table is made of two parts which fold together. The legs are detachable from both tables. Equipment packs closely together and takes up little room when it is being moved from place to place.

As in the application and interpretation of other biological tests, training and experience are essential. To avoid abuse of the test in incompetent hands and to enable poultrymen to get the most efficient results, the State Department of Agriculture, Springfield, Illinois, has arranged to accredit properly qualified veterinarians in various communities to conduct the test. This procedure provides a needed protection to the industry against imposters and enables flock-owners in every locality of Illinois to obtain the best possible results in the diagnosis of pullorum disease in breeding flocks.

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Requirements for State Standard Pullorum Accredited Flocks and Hatcheries*

SECTION 1. When the term "Standard" is used in the name of, or statement indicating condition of, hatchery, such as State Standard Accredited Hatchery or State Standard Accredited Chicks, the word "Standard" shall be considered as indicating that each bird in all flocks from which the hatchery using such term obtains its eggs has been inspected and leg-banded by State inspectors; and that after such inspection, each bird therein conforms in reasonable degree to the standard for the breed and variety as set forth in the American Standard of Perfection. This shall be construed as meaning that no bird decidedly off in type or color, or otherwise disqualified, shall be allowed to remain in the flock. Each bird must conform in a reasonable degree to the standard for high egg-production as set forth by the Division of Poultry Husbandry of the Illinois Department of Agriculture.

SECTION 2. When the term "Pullorum Disease Accredited" is used in connection with hatchery or baby chicks, it shall be considered as meaning that all flocks from which the hatchery in question obtains its eggs shall have been tested for pullorum disease in the manner prescribed by the Illinois Department of Agriculture. Any hatchery using the term "Pullorum Disease Accredited," in order to be eligible for the use of such term, shall first be a State Standard Accredited Hatchery.

SECTION 3. Any hatchery using the term "Standard State Pullorum Disease Accredited" shall be a hatchery which complies with all the above requirements and is so designated by the Illinois Department of Agriculture.

SECTION 4. The term "accredited" shall not be used in the state of Illinois in connection with hatcheries, hatchery flocks, eggs for hatching purposes or baby chicks, except as above provided.

SECTION 5. The prevention and control of pullorum disease is based upon sanitary measures in the testing of mature stock by approved veterinarians.

SECTION 6. To benefit by the plan the owner must place his flock under supervision of the Illinois Department of Agriculture for the control and prevention of pullorum disease.

SECTION 7. The Illinois Department of Agriculture will conduct coöperatively with the owner and approved veterinarian the plan for the control and eradication of pullorum disease in any flock or flocks in the State. The owner is the chief benefactor and should bear the expense of the approved veterinarian.

SECTION 8. The flock shall be tested annually for pullorum disease, and reactors to the test removed, houses disinfected, lots plowed and cropped where possible.

SECTION 9. Following testing and removal of reactors, the premises must be cleaned and thoroughly disinfected under the supervision of an approved veterinarian.

SECTION 10. The owner agrees to maintain his premises in sanitary condition and to purchase new stock from tested flocks only. At the same time the Illinois Department of Agriculture reserves the right to retest any accredited flock and the expense of retesting shall be borne by the Illinois Department of Agriculture, but when an accredited flock is found to be in such a state of health as to require a test of the whole flock, the expense shall then be borne by the flock-owner.

*Pullorum disease is used in these regulations in place of the term bacillary white diarrhea or the abbreviation "B.W.D."

SECTION 11. A pullorum-disease-tested flock of chickens is one in which the entire flock has been tested and the reactors removed and one which is maintained in a sanitary condition.

SECTION 12. A pullorum-disease-free-accredited flock of chickens is one in which the entire flock has passed a negative test and one which is maintained in a sanitary condition.

SECTION 13. Hatcheries complying with the above regulations, upon sworn affidavit of the approved veterinarian regarding sanitary conditions and operation, will receive an official certificate of the Illinois Department of Agriculture.

SECTION 14. The fee for testing may be arranged by the poultrymen and approved veterinarian on a per diem or per head basis. A list of approved veterinarians will be furnished hatcherymen by the Illinois Division of Animal Industry.

SECTION 15. Tests employed in pullorum disease control work shall be approved by the Illinois Department of Agriculture.

My Dogs

By ROBERT CRISLER*

Listen, my schoolmates, and you shall hear
Of the dogs I've had through all the years;
The first one I had was my greatest pet,
But the last one was the smartest yet,
And all the others to my heart were dear.

On Christmas, I got my first pup, Wags;
I never had witnessed a greater surprise.
He tumbled and rolled and wagged his tail,
But a car came along and blood left its trail,
And that was the end of my poor little Wags.

Trixie, my next, was quite a girl,
When she saw me coming, her tail made a curl;
She was affectionate, gentle, well-behaved,
And in the house she usually stayed,
But eating walnut shells led her to burial.

Bull was a bulldog, about four years old,
Who knew many tricks and was always quite bold.
He liked swimming in creeks and riding in cars,
Digging for moles and sniffing in jars;
But dogs are quite human, as I've been told.

He ran away soon, for he liked his first master best,
And of course you all know I was left in distress;
So next Christmas, my daddy gave me a pup, Tag,
Who was quite even smarter than my first pup, Wags,
But distemper overcome him; he left me like the rest.

Of the four dogs Ive had, not one now do I own;
So you see right now, I'm left entirely alone.
But I'll be patiently waiting,
'Til I find another worth taking,
And meanwhile I'll be saving up bones.

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*Robert is the eleven-year-old son of Dr. O. S. Crisler, of the University of Missouri.

SOME OBSERVATIONS ON CHLORIN AS A DISINFECTANT*

By WALLACE L. CHANDLER, *East Lansing, Mich.*
Michigan State College

Chlorinated lime and various hypochlorite preparations on the market have been found to be wholly ineffective for killing coccidial oöcysts *in vitro*[1] and for killing even the non-spore-forming bacteria embedded in even minute particles of fecal matter.[2, 3] Some recent observations by the writer, however, indicate that strongly acidulated hypochlorite solutions, containing upwards of 1,000 parts per million available chlorin, with acid in excess of the reacting amount, kill coccidial oöcysts and also sterilize fecal matter within ten minutes, when small amounts of finely divided fecal matter containing these organisms are shaken in a test-tube with an appreciable volume of the strongly acidulated hypochlorite solution.

Coccidial oöcysts have been observed to sporulate within 48 hours when a small amount of material containing washed specimens is left at room temperature in a large volume of strong hypochlorite solutions.[1] After several days of submergence in the hypochlorite solution, however, the oöcysts appear to have been dissolved. It has been observed also that comparatively small amounts of finely divided avian fecal matter containing coccidial oöcysts may be rendered bacteriologically sterile without injury to the oöcysts if this material is left standing for six hours at 40° F. in a large volume of a hypochlorite solution containing one per cent available chlorin.

Even when suspensions of fecal matter have been made decidedly acid, neither coccidial oöycsts nor all of the bacteria are killed by solutions of hypochlorites, at least not within one-half hour.† Sporulation of the oöcysts is in fact stimulated. Only when the amount of acid equals or is in excess of that required to complete the reaction between the acid and the hypochlorite are coccidial oöcysts killed within a ten-minute period.

Following the writer's observation some 12 years ago that washed specimens of nematode eggs and larvae are immediately killed when submerged in even weak solutions of elemental

*Approved for publication November 10, 1932, as Journal Article No. 129 (n. s.) from the Michigan Agricultural Experiment Station. Received for publication, November 12, 1932.

†It is hardly probable that chemicals, especially unstable ones, which will not kill coccidial oöcysts *in vitro* within a few minutes, have any value from the standpoint of their practical application to poultry house floors.

iodin,[4] attempts were made to utilize chlorin for the same purpose. These attempts were unsuccessful. Neither chlorin water nor hypochlorites, whether acidified or not, appear able to kill even washed specimens of nematode eggs within what may be considered practical time limits. Chlorinated lime, however, was found to dissolve nematode eggs within two or three days and for this reason, for a number of years, has been used by the writer to sterilize pipettes and other glassware with which worm eggs had been in contact.

For the reason that iodin solutions[1] were found ineffective for killing coccidial oöcysts, and the fact that chlorin would not kill worm eggs, it was not considered likely that chlorin would kill coccidial oöcysts. It was nearly two years following the discovery of colloidal elemental iodin[4-6] before it was observed that this form of iodin readily killed coccidial oöcysts. Following this observation, the possibility of chlorin as an agent for killing coccidial oöcysts still did not appear as likely, primarily perhaps because hypochlorites were used as solutions in which to sporulate coccidial oöcysts.

During the past summer, in the work by Mallmann and the writer, at this laboratory, on the lethal action of bacterial decomposition products of organic matter on coccidial oöcysts, attempts were made to learn something in regard to the function of oxygen in the sporulation of coccidial oöcysts. Avian fecal matter containing oöcysts was rendered bacteriologically sterile by suspending it for several hours in the ice-box in a sodium hypochlorite solution containing one per cent available chlorin. The material was then freed of the hypochlorite and washed by centrifugation with sterile water. Portions of this material were then suspended in various reducing agents with the intention of excluding oxygen. One of the solutions used was a five per cent zinc chlorid. In this material, contrary to expectations, a maximum sporulation was observed to have taken place within 18 hours, dichromate-treated samples requiring nearly 48 hours. This stimulation of sporulation appeared to the writer later as being due possibly to some toxic factor present in minute amounts, probably set free from a small amount of hypochlorite still adhering to the material, larger amounts of which might kill the oöcysts. At the first opportunity the writer, therefore, undertook some investigations on this problem.

As a first step leading to the solution of this problem, a small amount of avian fecal matter containing oöcysts was shaken in a test-tube with 5 cc of sodium hypochlorite containing one per

cent available chlorin. Five cc of a 5 per cent solution of zinc chlorid then was added. After 24 hours at room temperature, the precipitate which had formed in the test-tube was dissolved with potassium dichromate. Then the tube was centrifuged and the supernatant fluid replaced with a 2 per cent solution of potassium dichromate. Next the tube was allowed to stand at room temperature for 48 hours, at the end of which time no sporulation was observed to have taken place. Therefore, the oöcysts were considered to be dead.

It appeared to the writer that the lethal agent was probably nascent chlorin set free by the action of the hydrochloric acid produced in the aqueous solution of zinc chlorid, on the hypochlorite, and that the same results might be obtained by substituting hydrochloric acid for zinc chlorid. Experiments proved that the same results could be brought about by the action of hydrochloric acid on hypochlorites.

As the result of a large number of experiments, with varying strengths and volumes of hypochlorite, and various acids and varying amounts of intestinal contents containing coccidial oöcysts from turkeys, pheasants, pea fowls, rabbits and the small intestine and ceca of chickens, the following fact appears to be established: That when 0.1 cc of concentrated (centrifuged) finely divided fecal matter containing coccidial oöcysts is shaken in a test-tube with 10 cc of a hypochlorite solution containing, after acidification, not less than 0.1 per cent available chlorin and hydrochloric acid in amount corresponding to in excess of 1/10 N, coccidial oöcysts are killed within ten minutes.

This same method apparently also kills all of the bacteria present in the fecal matter, as attempts to culture bacteria from the contents of test-tubes after a ten-minute exposure consistently failed.

Therefore, it appears that the various species of coccidial oöcysts tested and also bacteria embedded in particles of fecal matter are killed within ten minutes when shaken in a test-tube containing 10 cc of a strongly acidulated hypochlorite solution, provided that:

(a) The amount of organic matter is finely divided and not excessive in volume. (In the above experiments, 0.1 cc of concentrated fecal matter or intestinal scrapings was used.)

(b) The amount of available chlorin in the hypochlorite solution is not less than 0.1 per cent and the amount of either hydrochloric or sulfuric acid is sufficient to give a strength correspond-

ing to a dilution of the commercial acid containing not less than one per cent.

(c) The hypochlorite is applied soon after it is acidified, since it rapidly decomposes.

If the strength of either the hypochlorite or the acid or the volume is appreciably reduced, or the amount of organic matter appreciably increased, the oöcysts will not be killed but their sporulation will be hastened.

It is the writer's opinion that the action of strongly acidulated hypochlorites in killing coccidial oöcysts and in sterilizing fecal matter is due to direct chlorination. This opinion is based on the following facts and assumptions:

1. The lethal action of colloidal iodin (Chandler) on coccidial oöcysts is due to a direct action of free iodin on these organisms. Chlorin, being a near relative of iodin, should act similarly.

2. If the lethal action is due to the oxidizing properties of the hypochlorous acid formed by the action of acid on the hypochlorite ($NaOCl + HCl \rightarrow NaCl + HOCl$), as is assumed by some writers to be the active principle in the chlorination of water, the bleaching process and some other uses, a minimum amount of acid would be required to start the reaction, for as the oxygen was removed from the HOCl, additional hydrochloric acid would be formed. As a matter of fact, a relatively large amount of acid is required in killing coccidial oöcysts with hypochlorites. The destruction of oöcysts by the oxidation properties of hypochlorites requires days instead of minutes.

3. The hypochlorous acid produced by the action of strong acids on hypochlorites combines with the hydrochloric acid also produced to liberate free chlorin.

$(CaCl_2 + Ca[OCl]_2) + 2H_2SO_4 \rightarrow 2CaSO_4 + 2\ HOCl + 2\ HCl$
(chlorinated lime)

$$HOCl + HCl = Cl_2 + H_2O$$

This reaction, of course, is reversible and in highly dilute solutions probably very little free chlorin exists, but in comparatively strong solutions and especially under the influence of excess acid the maximum amount of free chlorin probably is produced.

Whether the above *in vitro* observations on the lethal action of chlorin on coccidial oöcysts and bacteria embedded in particles of organic matter may lead to the practical application of chlorin as a disinfectant for use in poultry-houses, cow-barns, and the like, remains to be determined. It is quite likely that if a poultry-house is cleaned, as is recommended in directions for the use of

colloidal iodin, and a freshly acidulated hypochlorite containing 0.2 per cent or more of available chlorin is applied at the rate of about three gallons per 100 square feet of surface and agitated with a broom, disinfection against coccidia and bacteria may be practically accomplished. Worm eggs would undoubtedly escape injury, for chlorin, unlike colloidal iodin, exerts no action within practical limits of time on worm eggs. It is quite certain, however, that merely spraying the floor or applying a comparatively small volume of acidulated hypochlorites would do more damage than good in that it would hasten sporulation of the oöcysts.

As a word of caution to anyone experimenting with the practical application of chlorin as a surface disinfectant, it should be stated that chlorin is highly volatile and extremely irritating and corrosive, and it would be well for the operator to wear an efficient gas-mask.

Acknowledgments

The writer wishes to express his appreciation of the services of Mr. O. F. Edwards, graduate assistant at this institution, who made bacteriological test on the contents of various tubes submitted to him. The writer is indebted also to Dr. O. W. Schalm, a recent graduate of this institution and now a graduate assistant to Dr. J. R. Beach at the University of California. Dr. Schalm was employed for a short time to assist Mallmann and the writer in their experiments on the action of various bacterial cultures on coccidial oöcysts. He made counts of sporulated and unsporulated oöcysts from numerous cultures and was a witness to the fact that zinc chlorid apparently stimulated the sporulation of oöcysts. While this observation did not greatly impress either of us at the time, the writer feels that if it had not been for Dr. Schalm's apparently unlimited capacity for work, the observation might not have been made, due to lack of time for making frequent observations on the rate of sporulation of the oöcysts.

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CELL PROLIFERATION RESPONSE TO SULPHYDRYL ON AN EPITHELIAL DEFECT IN HORSES*

By C. E. HOWELL, *Davis, California*
College of Agriculture, University of California

For the past fifteen years, certain individual horses at the University of California, Davis, Calif., have exhibited an epithelial defect in the summer months. This defect is known by several names, but is commonly called summer sores. The condition and nature of the sores was described by Freeborn, Hart and Howell,[1] in 1927. These men presented evidence to show that the bursattee condition appeared every summer in the stock at Davis, Calif., in the complete absence of *Habronema* sp. The principal etiological factor in the epithelial defect is a genetic one.[2] Certain families of Percheron horses have been the only animals exhibiting this condition on the University Farm, where various breeds of purebred and also other grade horses and mules are maintained. The condition breaks out in small lesions at the onset of warm weather. This is followed by a process of ulceration which resists all healing efforts until the advent of cold weather. It may appear on any part of the animal's body.[3]

Since the defect is hereditary and developed by vicissitudes of temperature, it was postulated that normal cell metabolism must be disturbed. The animal manifesting clinical evidence of the defect had inherited a factor or a lack of a factor which inhibited normal cell growth. When high temperatures stimulate the formation of the lesions, it appears that cell division does not take place with sufficient rapidity and the accumulation of the old cells allows the necrotic ulceration to enlarge.

Cell division is the expression of underlying physiochemical processes.[4] Hammett has concluded that sulphydryl is the essential stimulus to growth by increase in cell numbers.[5]

Hammett and Reimann[6] also have shown that sulfur in a proper form will stimulate wound healing. The form used was of the SH- group attached to cresol.

*Received for publication, October 21, 1932.

Reimann[7] reports two cases of healing persistent sores in man. He used a preparation of p-thiocresol obtained from the Eastman Kodak Company. A hundredth gram was dissolved in 5 cc of 95 per cent alcohol, to which was then added 100 cc of distilled water, making a solution of 1:10,000. Reimann's directions and suggestions as given in the above-mentioned paper were followed as closely as it was possible to do so. However, working with this horse, which was allowed to remain in the stable, the aseptic conditions were difficult to control. Certain work around the barn interrupted the regularity of the applications of the treatment. Nevertheless, the results obtained showed definite evidence of healing the epithelial ulceration.

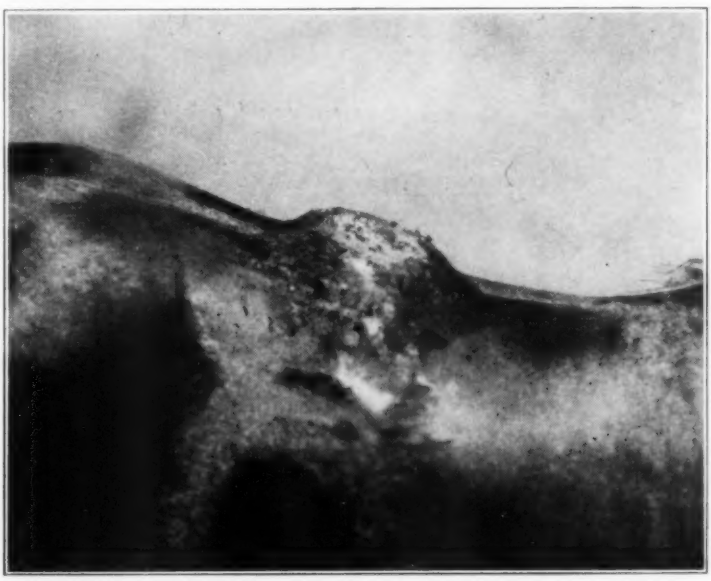

FIG. 1. Appearance of the summer sore on June 29, just before starting the treatment.

REPORT OF CASE

The Percheron stallion, California A1 139348, was born March 10, 1926. He has been affected with bursattee during the summers of 1928-29-30-31. His twin brother, also retained as a stallion, has never exhibited any clinical evidence of the defect.

During the summer of 1931, the epithelial defect was manifested by a large ulcerous growth on the loin (fig. 1). The season was one of high temperatures and prolonged hot spells.

The procedure of treating the sore was the same that Reimann followed in treating sores on man.[7]

June 30, 1931, the sore was rubbed briskly for about ten minutes with a stick of silver nitrate. The pepsin pack was put on at 10:00 a.m. and left until 2:00 p.m. The entire affected area then was washed as free of the débris as possible with a physiological salt solution. The treatment with the thiocresol solution was started at 2:30 p.m. and continued for 48 hours. A pack was made over the sore by covering it with a square of antiseptic gauze, then a thin layer of cotton and another square of gauze on

FIG. 2. Appearance of sore on July 26, after the third treatment.

top. The cotton was used to absorb the solution and the pack remained moist for a longer interval. The pack was moistened with the thiocresol solution at intervals of about one hour.

The thiocresol treatment was stopped at 2:30 p.m. on July 2 and the sore was kept moist with a physiological salt solution until the following day. A special set of harness apparatus was tried out to hold the pack in place. It consisted of a circingle, back-strap and crupper. This did not prove successful, as the various parts had to be buckled so tightly, to hold the pack in

place, that the leather parts caused sores to develop under the tail and around the heart-girth, due to the excessive pressure. While trying to get a suitable bandage to hold the pack in place, the thiocresol treatment was delayed until July 7. From July 3 to July 7, the sore was covered with an ointment as a fly repellant. This ointment had no healing effect because it has been used for the past 14 years on the sores without healing taking place. On July 6, another sore broke out just below the present one and

FIG. 3. Sore almost completely healed on August 22.

out of the old scar tissue of a previous sore formed the summer of 1930. July 7, the sore was cleansed thoroughly and the thiocresol treatment instituted for another 48 hours. On July 8, the tissue in the sore had a very healthy appearance. The area was free from any sign of pus. July 18, thiocresol was put on for another 48 hours. From July 22 to July 26, the weather was extremely warm, the maximum temperature for the week being

about 100 degrees. Despite the high temperature, the sore greatly improved and definite healing was manifest (fig. 2).

July 31 to August 1, another 48-hour treatment was given. The sore was much reduced in size and it was healing on all sides. The bandage was removed and the horse allowed to run in a corral for two days without any treatment of any kind on the sore.

August 4, another 48-hour treatment with thiocresol started. The horse then was turned out and allowed the run of a corral without any treatment or fly repellant.

August 19 to 20, another 48-hour treatment with thiocresol was applied. The sore now was almost completely healed and most of the epithelial layer was pigmented (fig. 3).

SUMMARY

1. Evidence is here presented showing that sulphydryl compound thiocresol definitely stimulated mitosis in one case of summer sores in horses. This defect has been one of the most resistant conditions to healing known in horses.

2. Favorable results have been obtained by the use of the sulphydryl group in stimulating mitosis in normal as well as persistent wounds. The successful treatment of this case of summer sores in this horse points to the fact that advantage might well be taken of the use of this substance in the treatment of persistent wounds in animals.

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TUBERCULOUS LESIONS OF THE EPICARDIUM OF A COW*

By WILLIAM H. FELDMAN, *Rochester, Minnesota*
Division of Experimental Surgery and Pathology
The Mayo Foundation

The lesions of tuberculosis of cattle, as ordinarily observed, are so characteristic as to be recognized readily without resort-

*Received for publication, November 25, 1932.

ing to laboratory procedures. The appearance of the lesions is rather specific, and their anatomic distribution is such as to constitute a rather definite picture of this common disease. Although the infective agent shows a predilection for such tissues as lymph-nodes, liver, spleen, lungs, kidney, and serous membranes, no tissue can be considered immune to the morbid influences of *Mycobacterium tuberculosis*. Consequently one may occasionally see lesions of tuberculosis affecting the intestines, bones, muscles, and even the central nervous system.

The subject of this report is unusual because of the distribution and gross appearance of the lesions.

Case Report

A three-year-old Holstein cow, which was slaughtered for food, had been considered, on antemortem inspection, to be in good

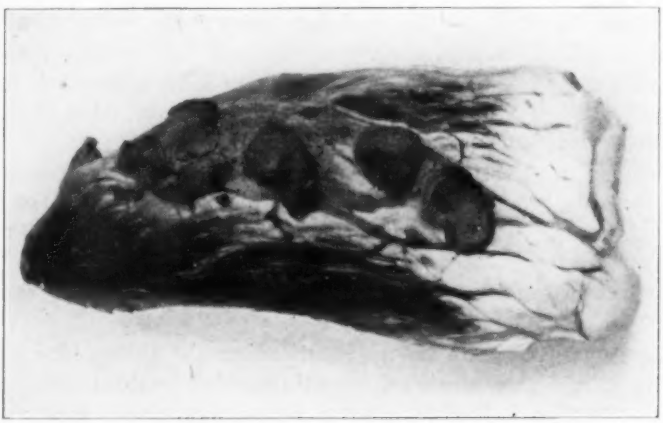

Fig. 1. Multiple granulomatous nodules on the epicardium of the heart of a cow. The lesions were caused by infection with *Mycobacterium tuberculosis*.

flesh; information concerning a tuberculin test was not available. Necropsy revealed lesions of actinomycosis in one submaxillary lymph-node and in the prescapular lymph-node on one side. Tuberculous lesions were observed in the anterior lobe of the right lung and in the lymph-nodes of the anterior mediastinum. At the base of the heart, extending over both auricles, and continuing over the pericardium, were multiple masses of grayish-pink tissue which appeared strikingly neoplastic. Somewhat loosely attached to the tissues of the large vessels where these structures entered the heart was a multiple cluster of nodular growths that were particularly striking in appearance. When the heart was

removed from the pericardial sac, numerous nodules similar in appearance to those involving the pericardium were found attached to the epicardium. The masses of tissue were limited to one side of the organ, and were arranged parallel to the longitudinal axis of the heart (fig. 1). Lesions were not observed in the myocardium or in the endocardium.

Pathologic anatomy: The respective tumor-like masses affecting the epicardium varied in size and contour from flattened, irregular tabs of tissue 0.5 to 1 cm. in diameter to somewhat flattened, nodular excrescences measuring from 2 to 3 cm. in their greatest dimensions. The lesions were invested with a thin, taut, serous encapsulation and were definitely limited in their attachment to the underlying elements of the epicardium. The respective nodular masses were rather loosely attached to the epicardial structure, and in many instances seemed to be superimposed on a layer of fat.

In the fresh state the nodular outgrowths were distinctly fleshy, and of a smooth, velvety consistence. After fixation, however, the surface was unevenly roughened by numerous, coarse granulations of variable dimensions. There was no evidence of necrosis, calcification or formation of abscess.

Sections prepared from the submaxillary and prescapular lymph-nodes, when examined microscopically, confirmed the original diagnosis of actinomycosis, made at necropsy. Typical lesions of tuberculosis, in which acid-fast bacillary forms could be seen occasionally, were observed in tissues prepared from the lung and mediastinal lymph-node.

Microscopically, the tissue constituting the tumor-like masses on the epicardium consisted essentially of collections of conglomerate tubercles. Highly cellular connective tissue was present in variable amounts around and between the various component units or tubercles. Associated with the connective tissue elements were a few lymphocytes and large numbers of monocytic cells. The more recent cellular response was evidently in that portion of the lesion adjacent to the epicardium, since here the reaction was more diffuse, with definite formation of tubercles not so frequent as in the more peripheral part of the nodule. The predominating cell concerned in the formation of tubercles was the so-called epithelioid cell, and giant-cells of the Langhans variety were commonly observed in many of the tubercles (fig. 2). In appropriately stained sections, acid-fast bacilli could be seen very rarely within an occasional giant-cell. Blood channels were few and neither necrosis nor calcification was seen.

The reactive process had obliterated discernible elements of the epicardium, but had not extended much into the myocardium. Although an accumulation of monocytic cells had taken place between a few of the more superficial muscle fibers, the tuberculous character of the cellular reaction was recognizable only in that portion of the structure which was originally the epicardium.

Altogether, the pathologic histology of the lesions of the epicardium disclosed a rather actively progressive, tuberculous

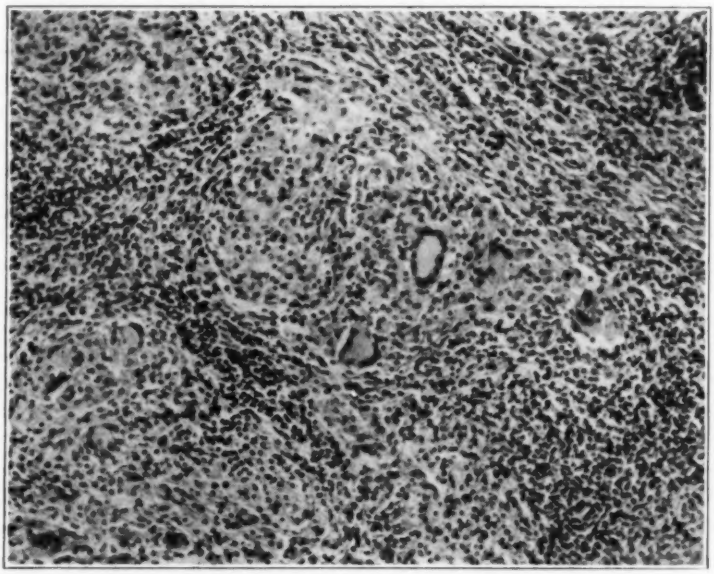

FIG. 2. Histologic appearance of a tuberculous nodule of the epicardium. The ill-defined collections of epithelioid cells and the numerous strands of fibrous connective tissue are characteristic of the condition.

process which was continuing unopposed by the usual retrogressive inhibitions such as necrosis, calcification and encapsulation.

COMMENT

The absence of lesions of tuberculosis in the endocardium, and especially in the myocardium, although present in generous numbers on the exterior of the heart, would indicate that the infection was conveyed to the heart by direct extension from the lesions in the pericardium, which in turn resulted from infection by continuity from the lesions of the mediastinum. There is no reason to believe that the cardiac infection was hematogenous.

Van Es[1] and Nieberle[2] commented on the rarity of tuberculous lesions of the heart in cattle, and the latter was of the opinion that involvement of the myocardium usually occurred as part of the picture of generalized tuberculosis, with such involvement most likely developing in young animals. Nieberle also described the pathology of myocardial tuberculosis, and pointed out that nodular myocardial lesions are usually associated with lesions of the pericardium.

The character of the cellular reaction in this instance is of some interest. As the tissue was richly cellular and devoid of the usual retrogressive changes commonly so characteristic of tuberculosis, one was confronted with a tissue response that was somewhat different from that which results when the disease occurs in a lymph-node or in the depth of parenchymatous tissue such as the lung, liver, or spleen. In the tissues named the provocative agent is surrounded on all sides by cellular elements which exercise inhibitory influences with the subsequent effect of slowing up the infective process and perhaps eventually resulting in necrosis and encapsulation. When the infection occurs on a serous surface such as the pleura, pericardium, or epicardium, the tendency is for the lesion to develop away from the point of attachment, and in so doing become a partially independent unit considerably separated from the inhibitory mechanism of surrounding tissues and dependent only on an adequate blood-supply for continued progression. Van Es has drawn attention to the "fungoid granulomatous" appearance of this variety of tuberculous lesion. In the fresh state, however, the granulomatous character of the tissue may not be apparent and the fleshy masses of tissue may simulate neoplasia. After fixation in a 10 per cent solution of formaldehyde (formalin), the presence at the surface of minute, rounded projecting granules is characteristic of tuberculosis.

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CARCINOMA TELEANGIECTATICUM OF THE TESTIS*

By ANGEL K. GOMEZ, *Los Baños, Laguna, P. I.*
College of Veterinary Science, University of the Philippines

On September 26, 1932, Dr. Tomas T. David submitted to the writer for diagnosis a tumor of the testicle which he surgically

*Received for publication, December 3, 1932.

removed from a Filipino pony in the town of Calauan, Laguna, P. I. The clinical protocol of the case is as follows:

Signalment: Equine, male, roan, 10 years, native.

History: Two months ago, the owner noticed that the right testicle of the pony was enlarging rapidly. At the time of the examination, the affected testicle was as large as an indoor baseball. On palpation, it was firm and heavy. The skin covering the organ was stretched and seemed adherent to the tumor.

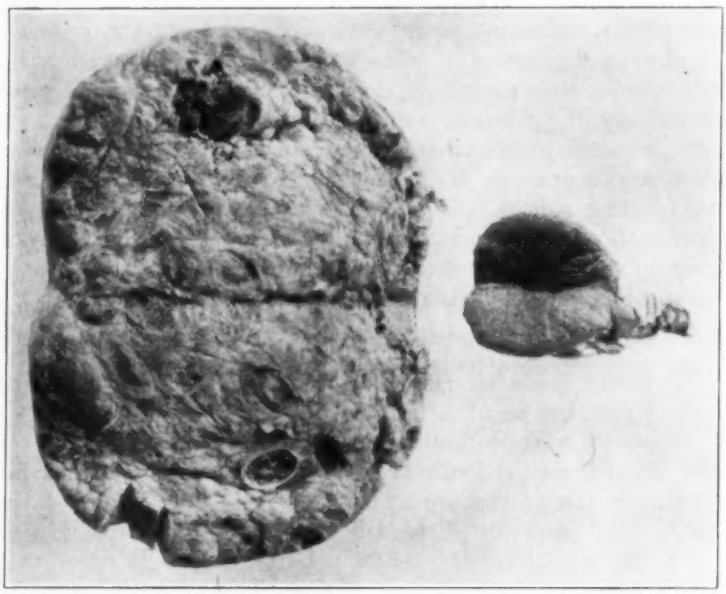

FIG. 1. Carcinoma teleangiectaticum of the testis (horse), showing teleangiectatic areas and solid cancerous tissue; left testicle also shown at right.

Small wounds, partly healed, were present on both sides of the scrotal sac. The left testicle was flabby and as large as a duck egg.

Diagnosis: Malignant tumor of the testicle.

Treatment: Castration and the application of a castration mixture.

Result: The animal made a good recovery.

DESCRIPTION OF THE TUMOR

The tumor, when examined in the fresh condition, was reddish gray and covered by a thickened dartos and tunica vaginalis communis. On section, the tumor mass was soft; the cut surfaces

had a grayish-white appearance, mottled with red areas about 2 to 3 cm. in diameter which, on close inspection, appeared to be composed of collections of small blood-vessels (fig. 1). The grayish portion, which appears nodular in some places, is composed of solid tissue. In the preserved condition (Kaiserling) the tumor measures 11 cm. x 16 cm. and weighs 1.663 kilos.

Histological sections from the red areas appeared under the microscope to consist of numerous dilated blood-vessels filled with red blood-cells. Between the blood-vessels a great number of cancer cells possessing round vesicular nuclei and a narrow margin of cytoplasm are seen. The sections from the grayish portion of the tumor show abundant, closely packed cancer cells of similar morphology, but numerous mitotic figures among them are present. In some places, there are evidences of testicular tubules which are enormously distended or markedly distorted by rapidly proliferating cancer cells, some of which are arranged in cords, which extend into the tunica albuginea. Very little if any evidence of stroma is present in the tumor. In fact, portions of the sections fell off during the process of staining.

COMMENT

The tumor above described is a malignant growth, as evidenced by its large size, acquired in a very short time, and the presence of numerous mitotic figures seen in histological sections. The cells are characteristically cancer cells and their origin must have been the epithelium of the tubules, since some of these tubules are markedly distended or distorted in certain places, due to accumulation of rapidly proliferating cells of epithelial cell type within their lumina. The red areas, which on microscopic examination show the presence of dilated blood-vessels filled with red blood-cells, reveal the teleangiectatic character of the tumor. Adami and Nichols state that carcinoma is of more frequent occurrence in the testis than sarcoma, for which it often has been mistaken. They also mention carcinoma teleangiectaticum as of relatively frequent occurrence in the testis of man.

The tumor being located in the testicle, *i.e.*, in a detached location, it had very little chance to metastasize. There was no evidence of this in the inguinal lymph-gland. The surgical removal of the tumor, which was done as soon as the condition was diagnosed, is responsible for the uneventful recovery of the animal.

Sign in the window of a Chicago restaurant during the International Live Stock Show: WELCOME LIVE STOCKMEN!

TUBERCULOSIS OF AVIAN ORIGIN IN MUSCOVY DUCKS*

By W. R. HINSHAW, *Davis, California*
University of California Agricultural Experiment Station

Subjects: Two male Muscovy ducks; one, slightly over a year old, and the second, 8 months of age.

History: Both specimens originated from the same ranch, located near Woodland, California. The first specimen was brought to the laboratory on October 29, 1931, by the owner, who discovered tuberculous-like lesions when it was killed and dressed for table use. The second was obtained by the writer on a visit to the ranch on June 15, 1932.

A small flock of Muscovy ducks had been maintained by the owner for four years. These had access to the ranch yards and mingled with a barnyard flock of chickens ranging from a few weeks to several years of age. No tuberculous-like lesions had been observed previously by the owner in either chickens or ducks, although on investigation it was found that tuberculosis existed among the chickens. The history obtained of losses and symptoms gave evidence that the disease probably had been present for several years, but had gone unnoticed by the owners because only young chickens were killed for table use, and none of the dead birds had been examined to determine the cause of death.

An attempt was made to obtain information on the incidence of the disease in the flock of ducks but the owner "unloaded" them on a Chinese poultry-dealer as soon as he discovered the presence of the disease. One female had escaped, however, and had hatched several ducklings, three of which remained at the time of the visit to the ranch on June 15, 1932. One of these was obtained for autopsy.

Autopsy: Only the dressed carcass, including the liver, heart, gizzard and lungs of the first specimen, was brought to the laboratory. Typical tubercles had replaced much of the normal tissue of the liver. The gizzard had been pierced by a piece of hay wire which had caused an adventitious cyst to project nearly 5 cm. from the surface of the gizzard. Acid-fast rods were demonstrated in scrapings made from the inner walls of the fistula of the cyst. A tuberculous mass, 5 x 8 cm. was attached to the left dorsal wall of the abdomen in the region posterior to the edge of the left lobe of the lung and involving the ribs and verte-

*Received for publication, December 6, 1932.

brae in this region. No lesions were observed in the lungs or heart. Acid-fast rods were demonstrated in smears made from the lesions.

The second specimen was killed for autopsy. It walked with an abnormal gait which it had had, according to the owner, since it was hatched. It was in good condition and the only organ affected was the spleen. This was slightly enlarged and one

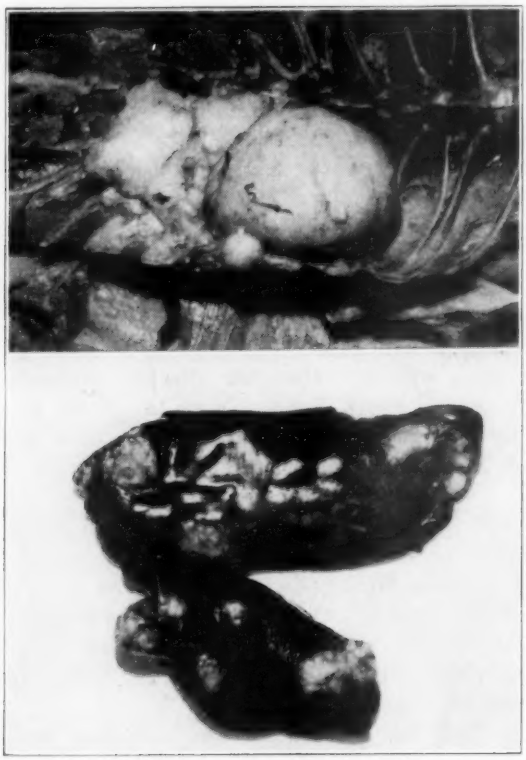

FIG. 1. Lesions of tuberculosis in the abdominal wall and liver of a duck.

tubercle the size of a millet-seed was observed. Acid-fast rods were demonstrated in smears made from this lesion.

Animal inoculation results: The results of animal inoculations are given in table I. All the animals were inoculated intraperitoneally with a saline emulsion prepared from pooled liver and abdominal lesions. The chickens were young White Leghorn males, previously negative to the tuberculin test.

The results tabulated in table I would indicate that the outbreak of tuberculosis in this flock of ducks was of avian origin. Since neither rabbit developed generalized tuberculosis, the type may be somewhat atypical of the avian strain. This lack of generalized infection may have been due to the method of inoculation, as it seems to be quite generally recognized that it is better to inoculate rabbits, for typing purposes, by the intravenous method rather than by the intraperitoneal method used in these trials. The fact that the flock of ducks was in close association with the tuberculous chicken flock is further evidence that the disease was of avian origin.

TABLE I—*Results of animal inoculations.*

ANIMAL	AMOUNT OF INOCULUM (CC)	DATE OF INOCULATION	DATE KILLED	RESULTS
Chicken 31	1.5	10–30–31	2–12–32	Yersin type of tuberculosis. Fair condition, no lesions, acid-fast rods in lung and liver smears
Chicken 32	1.5			Emaciated. Generalized tuberculosis
Rabbit 13	1.0		2–24–32	Lesions at point of inoculation only. Acid-fast rods demonstrated only in smears from lesions
Rabbit 23	1.0			Lesions at point of inoculation and in inguinal lymph-glands. Acid-fast rods only in smears from lesions
G. pig 29	1.0			Normal. No acid-fast rods demonstrated
G. pig 30	1.0			Normal. No acid-fast rods demonstrated

Summary: Two cases of tuberculosis in Muscovy ducks originating from the same ranch in central California are reported. Animal inoculations with infective material from one of the ducks and the fact that the flock was associated with a tuberculous flock of chickens indicated that they were suffering from the avian type of the disease.

Rabies Quarantine in Michigan

Reports of three persons in Battle Creek, Mich., bitten by dogs believed to have rabies, led to a temporary quarantine for all of Calhoun County recently.

INFECTIOUS DISEASES OF POULTRY. Prof. P. W. Sisoff, Institute of Veterinary Medicine, Moscow, U. S. S. R. 64 pages, with 31 figures in text. Government Publishing Trust, Moscow, 1932.

It is generally recognized that disease is one of the limiting factors in profitable poultry production. That the Soviet Government of U. S. S. R. is particularly aware of this is evident from the fact that during the past two years the Government Publishing Trust has published three books dealing with infectious diseases of poultry. The author of each of these books is Professor Sisoff, of the Institute of Veterinary Medicine, Moscow, U. S. S. R.

The first book, "A Manual of Infectious Poultry Diseases," 230 pages, has been reviewed elsewhere and therefore will not be discussed here. Suffice it to say that it is a most scholarly treatise on poultry diseases, written for practicing veterinarians, research workers and students of veterinary colleges.

The second book, "Infectious Poultry Diseases," is written for practical poultrymen, who have little or no knowledge of poultry diseases. The preface is characteristically addressed, "To Comrade Poultrymen!" It appeals to them to give the study of poultry diseases their earnest consideration and thought and stresses the advantages of modern methods of farming over those of pre-war times.

The book is a masterpiece in that it is written in a clear and concise manner, with great attention to detail, and is void of all technicalities. Nothing is taken for granted and everything is explained. According to the author, "That which is difficult to explain in words is made clear by means of illustrations." The book opens with a discussion on "Infectious diseases—a menace to the poultry industry." Considerable space is devoted to an explanation of what is an infectious disease. The bacteriological aspects of infection are discussed and illustrations are shown of various types of microörganisms. Sections dealing with disinfectants, with preventive measures, and with what to do in case of an outbreak of disease, take up from four to five pages.

The first disease to be discussed is fowl cholera, to which six pages are devoted. The essential points of the disease are then summarized in about half a page. Fowl pest, pullorum disease, chickenpox, tuberculosis, and coccidiosis are treated in a similar manner. Over twelve pages are devoted to a detailed description of so-called "roup." This disease appears to be very prevalent amongst poultry flocks of Soviet Russia. In order to bring out more clearly the insidious nature of the disease, the subject matter is dealt with in the form of questions and answers. The questions are asked by a practical poultryman and answered by a "veterinarian-scientist."

The book is remarkably up-to-date since, as far as the reviewers are aware, the latest available information in the English language is included in each of the chapters. The author is apparently not only well versed in the poultry literature published in English, but also in French and German.

It is interesting to note that the book was submitted for publication on December 21, 1931, was published on January 5, 1932, and contains 49,000 words and 31 illustrations. Fifty thousand copies were published in the first edition.

The third book on "The Diagnosis of Infectious Poultry Diseases" will be dealt with in a later review.

J. B. and V. E. P.

UNTERSUCHENGEN ÜBER DEN BAU NORMALER UND DURCH CALCIUM-UND PHOSPHORARME NAHRUNG VERÄNDERTER RINDERKNOCKEN. (Investigations on the Structural Changes in the Bones of Normal Cattle and of Cattle Receiving Calcium- and Phosphorus-Deficient Diets.) Sir Arnold Theiler. Memoir Volume 68, Treatise 1, Natural History Society of Switzerland, 1932.

The subject is presented in two parts. Part I deals with the structure and thickness of the cortical portions of the bones of cattle and Part II with experimental rachitis and osteomalacia in cattle. The histologic features are particularly emphasized. The objective in Part I is to present material from the normal bovine and includes an unborn fetus (77 cm. head-rump length), a five-day-old calf and two full-grown cows which had received rations that supplied adequate mineral elements, especially calcium and phosphorus. In Part II the material for study was obtained from the animals used in studies on rachitis and osteomalacia in South Africa. The animals in this group had received various rations which supplied various levels of calcium and phosphorus. Thus, some of the animals received rations that

were low in calcium and low in phosphorus; others, rations in which both these elements were in abundance; others, in which the ration carried only a small amount of calcium but a relatively high amount of phosphorus and still others in which the rations contained high amounts of calcium but low amounts of phosphorus.

A systematic procedure was adopted for the collection of the material for study. The collection represented the different classes of bones; long bones, irregular or short bones and flat bones. Portions of the shaft of the humerus, portions of the shaft and distal epiphysis of the radius, olecranon of the ulna, proximal and distal epiphyses of the metacarpus, a complete phalanx, shaft of the tibia, and shaft, proximal and distal epiphyses of the metatarsus were representative of the long bones. Of the irregular bones, the first thoracic and first and sixth lumbar vertebrae were chosen. To represent the flat bones, portions of the proximal and distal ends of the third and thirteenth ribs were taken as was also the proximal and distal ends of the scapula. Sections were taken also from the body and tuber sacrale of the ilium and from the tuber ischii of the ischium. From the head, sections from the frontal and mandibular bones were collected. In addition sections were removed from some of the articular surfaces, the subarticular zone and the spongiosa.

The descriptions and discussions are presented in a clear, concise and detailed manner. In connection with the normal histology, the author discusses the arrangement of the vascular network in the compact bone, the Haversian systems, the perforating and lamellar fibers of Sharpey and the arrangement of the periosteal and osteoid structures. The histo-pathological descriptions are complete to minute detail and the various tissue changes are discussed in the light of their comparisons to the changes reported as characteristic of rachitis and osteomalacia in man.

The arrangement of the material in Part II is in the fashion of protocols. This includes a brief reference to the mineral status of the ration, a description of the macroscopic findings in general and of the bones in particular and then this is followed by a description and discussion of the microscopic findings in accordance with a particular bone or part selected for study.

The monograph is well illustrated with excellent photomicrographs of which there are 24 showing the microscopic anatomy of the normal tissues and 48 from the mineral-deficient cattle.

Four Röntgenograms of the metatarsi and metacarpi are included.

The paper used for this publication is a high quality enamel paper and the typography is excellent. The author is to be commended for his careful work and its preparation, the Society for its publication, and the craftsmen for their part in the ultimate realization of the undertaking.

H. C. H. K.

ECONOMIC MAMMALOGY. Junius Henderson, Curator, University of Colorado Museum, and Elberta L. Craig, Museum Assistant. 397 pages. Charles C. Thomas, Springfield, Ill., and Baltimore, Md., 1932. Cloth, $4.50 postpaid.

In this book the authors have brought together, under one cover, a large amount of scattered information on various phases of economic mammalogy. The average individual probably has only a slight conception of the scope of this field and this new book is highly illuminating in this respect. The authors have drawn on hundreds of publications for their material and their sources of information are to be found in the extensive bibliography appended to the book.

In part I are discussed the important facts and principles of economic mammalogy. In part II is presented a systematic discussion of the economic relations of the various groups and species of mammals. The various orders and families of mammals are treated in a systematic fashion and copious references enable the reader to refer to the sources of the material comprising the book, which necessarily is presented in condensed form. As pointed out by the publisher, the book serves as an index-digest of the very numerous but scattered papers on American economic mammalogy.

One possible criticism of the book might be made on the score that the statistical data to be found in certain chapters appear to be far from up to date. Many of the figures given are at least five years old and in some cases older. The value of the book for reference purposes could have been materially increased by bringing these figures reasonably up to date. For example, the data covering the number and value of the more important domestic mammals in the United States were for the year 1925. Figures covering exports from and imports to the United States also were for 1925.

The mechanical features of the book have been well executed. For a first edition it is comparatively free of typographical errors.

VETERINARY PATHOLOGY AND BACTERIOLOGY. S. H. Gaiger, F. R. C. V. S., Professor of Animal Pathology, University of Liverpool, and Gwilym O. Davies, M. V. Sc., M. R. C. V. S., D. V. H., Lecturer in Animal Pathology, University of Liverpool. 610 pages, with 194 figures. Alexander Eger, Chicago, 1932. Cloth, $6.75.

The authors of this new work have undertaken a rather difficult task—that of writing a book on veterinary pathology and bacteriology and keeping the size down to 578 pages of actual text. The book thereby reverses the recent trend toward specialization of subject matter. No one will deny the intimate relationship between bacteriology and special pathology in many diseases and the advantages of having these two important subjects presented under one cover. The presentation of special pathology makes it practically necessary to include general pathology, which is covered in the first part of the book, consuming about 80 pages.

It has been the aim of the authors to produce a book primarily for the use of veterinary students and secondarily for the use of practitioners. This has added to the difficulties of the task. Of necessity, the student must assimilate a great mass of material in concentrated form. The average student has neither the time, the capacity nor the inclination to absorb a great amount of detailed information. In this respect the authors appear to have done a good job. On the other hand, the graduate veterinarian, either in practice or in some other field, will be disappointed at the brevity with which important subjects necessarily have been treated.

The nomenclature of the Society of American Bacteriologists has been adopted by the authors, with slight modifications. In some cases synonyms are given and not in others. No small amount of space is consumed needlessly by repeating the specific names of organisms when these could be abbreviated just as well.

The reader is referred to other publications in a number of instances, but no references are given. In the preface the authors state that they purposely have omitted a bibliography. In the opinion of the reviewer, some references would be of much more value than some of the illustrations, which rate from very good to very poor. The compilation of the index (30 pages) appears to have been done very carefully and thoroughly. An appendix of 34 pages contains very brief outlines of a number

of laboratory procedures, formulae for culture media and directions for the collection of specimens for laboratory diagnosis.

On the whole, the book is a credit to both the authors and the publisher. Numerous statements relative to certain diseases will be questioned by American readers, in the same way that British veterinarians might question statements made by their colleagues on this side of the Atlantic. Some of these differences are largely of opinion only, the natural result of other differences in the conditions found in the two countries.

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Further Studies on the Relation of the Milk Agglutination Titre to the Elimination of *Bact. Abortus* from the Udder of the Cow. Herbert L. Gilman. Reprint from *Corn. Vet.*, xxi (1931), 3, pp. 243-251.

A Study of Some Factors That Influence the Agglutination Test for Bang Abortion Disease in Cattle. Clifford H. Milks. Reprint from Rpt. N. Y. State Vet. Coll. for 1930-1931, pp. 85-116.

CHANGES IN THE BLOOD ASSOCIATED WITH FEVER INDUCED BY KILLED B. COLI. M. Garcia Banus and Emanuel Ginsberg. Amer. Jour. Physiol., ci (1932), 1, p. 106.

High body temperatures lasting for more than 10 hours were induced in dogs by subcutaneous injections of typhoid and *B. coli* vaccines and by intravenous injections of killed *B. coli* suspensions. When subcutaneous injections are given, the temperature rises slowly, increases with every four successive injections, comes to a peak after about eight hours and drops quickly thereafter. When intravenous injections are given, the temperature rises quickly, a maximum being reached after three to five hours, and is not influenced by any further injection. It remains high for several hours and then drops slowly. There is a marked increase in blood concentration, an increase in the oxygen capacity and hemoglobin concentration, an increase in the alkaline reserve of the blood and an increase in the buffering power of the blood. The blood concentration continues to increase after the temperature has begun to drop. After the peak is reached, the fall of oxygen capacity and hemoglobin is greater than can be accounted for by the corresponding fall in blood concentration.

THE RELATION OF DIET TO THE SUSCEPTIBILITY OF DOGS TO ANCYLOSTOMA CANINUM. A. O. Foster and W. W. Cort. Amer. Jour. Hyg., xvi (1932), 1, p. 241.

The results of experiments on nine dogs showed a relationship between diet and susceptibility to infection with the dog hookworm, *Ancylostoma caninum*. The undernourished condition was characterized by a breaking of the resistance due to previous infection and age. There was also an increased development of the worms and an increased egg-production of the females. When such dogs were placed on a good diet their recovery of resistance was indicated by a reduced egg-production of the worms present, loss of worms, and resistance to further infection.

CRITICAL ANTHELMINTIC TESTS OF CHLORINATED ALKYL HYDROCARBONS AND A CORRELATION BETWEEN THE ANTHELMINTIC EFFICACY, CHEMICAL STRUCTURE AND PHYSICAL PROPERTIES. Willard H. Wright and Jacob M. Schaffer. Amer. Jour. Hyg., xvi (1932), 2, p. 325.

Critical anthelmintic tests for intestinal parasites of the dog have been carried out with a number of chlorinated alkyl hydrocarbons. The most promising of these for the treatment of hookworm disease are n-butyl chlorid, 2-chlorpentane, 3-chlorpentane and n-butylidene chlorid. These compounds in therapeutic dose showed a high degree of anthelmintic efficacy for hookworms and were well tolerated by the host. The gross and microscopic pathology associated with the administration of these compounds was not sufficient to militate against the use of the compounds as anthelmintics for the dog. Gross pathological alterations of varying intensity in the gastrointestinal tract, the liver and the kidneys of the treated dogs were associated with nearly all of the compounds tested. Histologic changes in the livers of treated dogs were associated with nearly all of the compounds tested, and changes in the kidney were associated with the administration of a few of the compounds.

THE EFFECT OF A DEFICIENT DIET ON THE SUSCEPTIBILITY OF DOGS AND CATS TO NON-SPECIFIC STRAINS OF HOOKWORMS. A. O. Foster and W. W. Cort. Amer. Jour. Hyg., xvi (1932), 2, p. 582.

Three types of resistance to infection appear to be manifested in the host-parasite relationships between the dog and the cat and their hookworm parasite, *Ancylostoma caninum*. One of these is an age resistance unrelated to previous infection which manifests itself even before the maturity of the host and becomes very pronounced in old dogs and cats. This type of resistance never becomes so complete that light infestations cannot be produced when given large numbers of larvae. Previous infection also seems to produce some resistance. A deficient diet seemed to break down a resistance in which both previous infection and age appeared to have a part. Another type of resistance is that shown by the dogs and cats to the non-specific strains of *A. caninum*. A deficient diet in puppies was responsible for an increased susceptibility of the experiment dogs to infection with the cat strain of *A. caninum*. Cats on a deficient diet were also slightly more easily infested with the dog strain of *A. caninum* than mature cats with this strain.

THE INFLUENCE OF NUTRITION ON SUSCEPTIBILITY TO A BACTERIAL TOXIN. T. J. Mackie, M. H. Fraser, A. H. H. Finkelstein, and E. M. J. Anderson. Brit. Jour. Exp. Path., xiii (1932), 4, p. 328.

Four different rations given to separate groups of sheep produced a clear differentiation in growth, in death rate, and in general health in the order named: 1 (best), hill pasture, maize, and mineral mixture; 2 (intermediate), hill pasture and maize, hill pasture and mineral mixture; 3 (worst), hill pasture only. Their resistance to the toxin of the lamb dysentery bacillus, judged by cutaneous reactions, was in the same order. This group variation was clearly marked in the early summer and disappeared in the autumn. The authors suggest that dietary deficiencies increase susceptibility to the action of a bacterial exotoxin and that nutritional factors would afford a profitable line of study in relation to immunity to infective disease.

EXPERIMENTAL INFLAMMATION OF THE COLON. (a) Relationship of mucus production in goblet cells to the Golgi apparatus; (b) Mitrochondral changes. Howard Florey. Brit. Jour. Exp. Path., xiii (1932), 4, p. 349.

Evidence has been produced from the rat, cat, dog and rabbit that mucous granules are formed in intestinal cells in the region of the Golgi body. No evidence has been obtained that the Golgi material is "used up" in elaborating the secretion. Goblet-cells are distinct entities, although starting from an indifferent cell. The mitrochondral differences are marked between the goblet-cells in the exhausted cat colon and the epithelial cells, but are not a permanent distinctive feature. A goblet-cell which is exhausted of its mucus content can secrete mucus again, the author's theory being that the manufacture of mucus in the Golgi area is taking place at the same time that the mucus is being discharged.

GROWTH AND METABOLISM OF THE BOVINE PLEUROPNEUMONIA VIRUS. Barbara E. Holmes and Antoinette Pirie. Brit. Jour. Exp. Path., xiii (1932), 4, p. 364.

An attempt has been made to estimate the growth of the filter-passing organism of bovine pleuropneumonia by estimating its metabolism. There is little or no production of ammonia in cultures, and no perceptible increase in amino nitrogen. There is a slight fermentation of glucose during the first 24 hours of culture and a very large fermentation during the second 24

hours. The pleuropneumonia organism can reduce methylene blue in the presence of sodium lactate. The growth of the virus in culture can thus be conveniently estimated by following the increase in lactic dehydrogenase in the culture. No hydrogen donators have been found other than lactate.

A Simple Method for the Study of the Sporulation of Coccidial Oöcysts. K. Wagener. Arch. Path., xiv (1932), 2, p. 213.

From 0.8 to 1.0 per cent of agar dissolved in distilled water and poured into Petri dishes constitutes a simple medium for studying the sporulation of coccidial oöcysts. The feces containing the oöcysts are smeared thinly on the surface of the agar and can be examined directly under the microscope by using the low magnification, the high magnification or even the oil immersion systems.

A Pigment in the Sweat and Urine of Certain Sheep. C. Rimington and A. M. Stewart. Abst. Arch. Path., xiv (1932), 2, p. 248.

The golden-brown coloration of the wool fiber of many sheep appears to be due to a pigment, lanaurin, which is secreted in the sweat. The pigment may be isolated from both the wool and the urine. It is a pyrrolic complex and probably occupies an intermediate position between the bile pigments and fully condensed melanin. The condition in sheep resembles familial acholuric jaundice in man. Both phenomena may be due to a hereditary tendency to hyperactivity on the part of the cells of the reticuloendothelial system, with increased destruction of hemoglobin. Lanaurin may be considered to be derived from hemoglobin and to be excreted by the renal and sudorific systems.

Histological Studies on Hog Cholera. II. Lesions of the vascular system. O. Seifried and C. B. Cain. Jour. Exp. Med., lvi (1932), 3, p. 345.

The earliest and most pronounced lesions in cases of acute hog cholera occur in the capillaries and smaller arteries. Larger arteries and veins are less frequently involved. The lesions consist of swelling and proliferation of the endothelial cells together with retrogressive changes in them and in the other parts of the blood-vessel walls. The character and degree of these lesions seem to depend upon the virulence of the virus and to some extent upon the presence of secondarily invading bacteria.

HISTOLOGICAL STUDIES ON HOG CHOLERA. III. Lesions in the various organs. O. Seifried and C. B. Cain. Jour. Exp. Med., lvi (1932), 3, p. 351.

The hemorrhages, foci of necrosis, and anemic infarcts met with in the various organs in virus hog cholera result primarily from the vascular lesions. Although they are not dependent upon the presence of secondarily invading bacteria, their severity is influenced by these organisms. The lesions in the lymph-nodes, spleen, kidneys, and central nervous system seem to be of special diagnostic value in questionable cases of cholera.

THE DISINFECTION OF ANTHRAX-INFECTED DRIED HIDES IN THE DRY CONDITION BY MEANS OF HYDROGEN SULFID. Madge E. Robertson. Jour. Hyg., xxxii (1932), 3, p. 367.

Hydrogen sulfid has been found to have a destructive action on dry anthrax spores. Disinfection of hard, dry, very resistant hide specimens, in conditions both of ease and difficulty of access of the disinfecting gas, has been obtained by treatment with hydrogen sulfid at 20° C. and at 37° C. in periods of 7 to 16 days. The fact that hydrogen sulfid in the experimental conditions described penetrates to the middle of a bundle of leather pockets has been verified by its action in disinfecting anthrax-infected threads placed in the middle of a bundle. Increase in the temperature at which treatment is carried out has been found to hasten disinfection. Disinfection of anthrax-infected threads has been obtained by treatment with equal parts of hydrogen sulfid and air in three days at 60° C.

THE APPEARANCE AND THE SIGNIFICANCE OF THE UNFERTILIZED EGGS OF ASCARIS LUMBRICOIDES. G. F. Otto. Jour. Parasitol., xviii (1932), 4, p. 269.

Unfertilized eggs were found to represent 15.9 per cent of 51,329 ascaris eggs seen in 820 small drop preparations of the Stoll dilution egg-count method. These eggs were found alone in 26 per cent of the slides, mixed in 42 per cent and absent in 32 per cent. They were distributed in high and low egg-counts, but most of the slides having just unfertilized eggs had low egg-counts. Unfertilized eggs are asymmetrical and all are figured. Single female worms may be producing either only unfertilized or fertilized eggs at one time or both at the same time.

Regular Army

Major Charles O. Grace is relieved from assignment and duty at Fort Clark, Tex., effective on or about January 15, 1933, and will proceed to Fort Benning, Ga., for duty.

The promotion of Captain Nathan M. Neate to the grade of major to rank from November 24, 1932, is announced.

Veterinary Reserve Corps

Promotions

	To	
Ash, Harley Edwin . .	Capt. . .	118 E. Court St., Bowling Green, Ohio.
Nye., Wm. Clinton . .	1st Lt. . .	312 Federal Bldg., Boise, Idaho.

BUREAU TRANSFERS

Dr. A. J. Maloney (Corn. '06) from Yakima, Wash., to San Diego, Calif., on meat inspection.

Dr. E. G. Pigman (K. C. V. C. '13) from Chicago, Ill., to Houston, Texas, on meat inspection.

Dr. M. L. Crans (K. C. V. C. '16) from Terre Haute, Ind., to Kansas City, Kan., on meat inspection.

Dr. LeRoy P. McArdle (K. C. V. C. '13) from Watertown, S. Dak., to Albert Lea, Minn., on meat inspection.

Dr. H. C. Berger (Cin. '17) from Palestine, Texas, to New Roads, La., on tick eradication.

Dr. W. R. Kidwell (O. S. U. '19) from Spokane, Wash., to Butte, Mont., in charge of meat inspection.

Dr. F. G. Miller (Iowa '08) from Butte, Mont., to Ogden, Utah, in charge of meat inspection.

Dr. C. B. Barber (Colo. '30) from Chicago, Ill., to New York, N. Y., on meat inspection.

Dr. W. E. Dodsworth (Colo. '15) from Ennis, Texas, to South Saint Paul, Minn., on meat inspection.

Broadcast Animal Welfare Talks

Weekly radio talks on timely topics incident to animal welfare are being given under the auspices of the Pennsylvania S. P. C. A., through the courtesy of the Philadelphia Chamber of Commerce, over Station WDAS each Wednesday at 1:45 p. m., E. S. T. The series of five-minute talks began November 30, 1932, and will end February 22, 1933.

New York Broadcasting Program

The weekly radio talks given under the auspices of the Committee on Broadcasting of the New York State Veterinary Medical Society are being continued this year. The following list includes those talks given during the latter part of 1932, as well as those to be given during January and the first two weeks of February, 1933:

October 19—"Bang's Disease—A Control Plan," Dr. J. G. Wills, New York State Department of Agriculture and Markets, Albany.

October 26—"Bang's Disease with Plan of Control," Dr. Charles Linch, New York State Department of Agriculture and Markets, Albany.

November 2—"Dairymen and Other Friends Buying Replacements for Our Dairy Herds," Dr. P. V. Weaver, Greenwich.

November 9—"Dairy Farm Water Supplies," C. R. Cox, New York State Department of Health, Albany.

November 16—"Do's and Don'ts for Farm Animals," Dr. F. W. Andrews, Mount Kisco.

November 23—"Some Internal Parasites of the Horse (Bot Fly Control)," Dr. B. J. Cady, U. S. Bureau of Animal Industry, Albany.

November 30—"When Happy Days Are Here Again," Dr. J. S. Carnrite, Fort Plain.

December 7—"Clipping Cattle," Dr. Crittenden Ross, New York City Department of Health, New York City.

December 14—"Farm Dogs," Dr. A. E. Merry, Syracuse.

December 21—"The Veterinarian and Public Health," Dr. P. B. Brooks, New York State Department of Health, Albany.

December 28—"Mange in Cattle," Dr. B. J. Cady, U. S. Bureau of Animal Industry, Albany.

January 4—"Veterinarians' Registration Law," C. B. Heisler, New York State Department of Education, Albany.

January 11—"Dog Law as It Relates to Farm Animals," Merton Reynolds, New York State Department of Agriculture and Markets, Albany.

January 18—"Feeding Dairy Cows in Winter," Prof. E. S. Savage, New York State College of Agriculture, Ithaca.

January 25—"Cattle Indigestions," Dr. A. L. Smith, Mechanicville.

February 1—"Dehorning Cattle," Dr. F. D. B. Smith, East Chatham.

February 8—"The Udder of the Healthy Cow," Dr. J. N. Frost, New York State Veterinary College, Ithaca.

The talks are broadcast over Station WGY (General Electric Station) Schenectady, N. Y., at 12:20 E. S. T., each Wednesday.

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Iowa Veterinary Medical Association Annual Meeting

Dr. Karl F. Meyer, internationally famous veterinarian and director of the Hooper Foundation for Medical Research, San Francisco, will be among the many outstanding guest speakers at the forty-fifth annual meeting of the Iowa Veterinary Medical Association in Des Moines, January 10-11-12.

Other out-of-state speakers scheduled to appear are Dr. James Farquharson, Colorado Agricultural College, Fort Collins; Dr. Robert Graham, University of Illinois, Urbana, and Dr. W. A. Axby, practitioner, Harrison, Ohio.

Members of the Cedar Valley (Iowa) Veterinary Medical Association will present a symposium on cattle practice. A similar symposium on swine diseases and swine practice will be presented by the members of the Eastern Iowa Veterinary Association. Case reports by several outstanding Iowa practitioners will fill in the very practical program that has been arranged.

Officers of the Ladies' Auxiliary are rounding into shape a very interesting program for visiting ladies. Among other things, arrangements have been made for a group visit to the internationally famous Smouse Opportunity School for Handicapped Children.

Condemns Worthless "Cures"

No less than 8,000 so-called "cures" for various diseases of live stock were pronounced worthless by the U. S. Department of Agriculture during 1931.

CENTRAL NEW YORK VETERINARY ASSOCIATION

The twenty-third semi-annual meeting of the Central New York Veterinary Association was held at the Onondaga Hotel, Syracuse, November 1, 1932. The meeting was called to order at 2:30 o'clock by the President, Dr. W. F. Burleigh. Roll-call showed thirty members and visiting veterinarians in attendance.

Following the reading and approval of the minutes of the previous meeting, Drs. C. L. Loup, of Cazenovia, and George Wohnsiedler, of Carthage, were elected to membership. By unanimous vote, three of the visiting veterinarians were elected honorary members: Drs. W. A. Hagan, J. G. Wills and H. C. Stevenson. The invitation of Dr. Almond H. Ide, of Lowville, to hold the June, 1933, meeting of the Association in his city, was accepted.

The literary program consisted of papers which were read by Drs. W. A. Hagan, J. G. Wills and H. C. Stevenson. The discussion of these was opened by Dr. W. G. Hollingworth.

Dr. W. H. Bales reported that Dr. Baldwin's father, who had been missing since the afternoon of the previous day, had been found dead. Dr. Bales was asked to express the sympathy of the Association to Dr. Baldwin in person. The Secretary was instructed to send a message of sympathy to the family of the late Dr. D. D. Le Fevre, of Newark.

The meeting then adjourned to allow the accredited veterinarians present to hold a short meeting. Following this, a fine banquet was served, at which the ladies joined the gentlemen. The arrangements for this function were made by President Burleigh, as a celebration of the seventy-fifth birthday of the Secretary, Dr. W. B. Switzer, who was presented with a beautiful birthday cake with a suitable inscription. Dr. Switzer then proceeded to cut the cake, and it was served to all those present. At the close of the dinner, Dr. Switzer was presented with a beautiful desk set. Dancing followed, and this number brought to a close one of the best meetings in the history of the Association.

W. B. SWITZER, *Secretary.*

MICHIGAN-OHIO VETERINARY MEDICAL ASSOCIATION

The semi-annual meeting of the Michigan-Ohio Veterinary Medical Association was held at the Courthouse, Adrian, Mich., on Thursday afternoon, November 10, 1932. There were about twenty-five present and very keen interest was displayed throughout the meeting. Evidently the veterinarian believes that better practicing conditions are ahead of him for the coming year.

Dr. Fred D. Guthrie, Michigan representative of the Jensen-Salsbery Laboratories, discussed the methods of bot eradication being used in other states.

Dr. R. C. Julien, consulting veterinarian for the Allied Laboratories, gave a very able discussion of some of the swine diseases which are encountered in southern Michigan and northern Ohio. He emphasized the necessity for a knowledge of the various diseases, so the veterinarian would be able to make a differential diagnosis, which is so important in post-vaccination troubles.

Dr. B. J. Killham, extension specialist from the Michigan State College, summed up some of the work he has done in extension work with Bang's disease. He has at all times protected the practicing veterinarian against the encroachment of the layman in this field of endeavor.

E. C. W. SCHUBEL, *Secretary.*

SOUTH EASTERN WISCONSIN VETERINARY ASSOCIATION

The regular November meeting of the South Eastern Wisconsin Veterinary Association was held at Jefferson, Wis., the evening of November 17, 1932. Group 6 entertained by providing a turkey banquet.

Dr. Harry D. Larzelere, of the U. S. Bureau of Animal Industry, gave a talk on the diseases of young pigs. This subject was discussed by Dr. E. L. Morgenroth, of Kewaskum, and Dr. Edward Boesewetter, of West Bend.

Dr. H. M. O'Rear, of Washington, D. C., gave a very able discussion on the control of bovine tuberculosis throughout the United States. He also described his technic for injecting tuberculin in the vulva in conjunction with the caudal fold, in testing for tuberculosis.

Dr. J. S. Healy, of Madison, in charge of federal tuberculosis eradication work in Wisconsin, gave a résumé of the progress

made in the control of avian tuberculosis, as the work is being conducted in Sheboygan and Rock counties.

Dr. B. A. Beach, of the University of Wisconsin, gave a talk on the new testing-box for Bang's disease, which he hopes will eliminate some of the present disadvantages in connection with field testing for Bang's disease.

A general discussion then took place, relative to the regulation of New York State, covering the entry of cattle into that state, only from herds that are free of Bang's disease. This regulation is seriously affecting the export of Wisconsin cattle.

J. O. McCoy, *Secretary.*

NEW ENGLAND VETERINARY MEDICAL ASSOCIATION

The third annual meeting of the New England Veterinary Medical Association was held in Boston, Mass., November 14-15, 1932. Morning sessions were held at the Hotel Bradford and afternoon clinics at the Angell Memorial Hospital. Well over one hundred veterinarians were in attendance at the meeting and it was voted by all as one of the most successful veterinary meetings ever held in New England.

The Monday morning session was opened with an address from the President, Dr. P. R. Baird, Waterville, Maine. Dr. Baird emphasized the advantages of attending meetings of this kind and stated that the program had been arranged with the idea of rendering as much practical assistance to busy practitioners as possible, so that the time and expense involved in attending the meeting would be more than offset. He also pointed out the advantage which comes to many of the men who are unable to attend larger association meetings by contacting fellow practitioners who have problems similar to their own with which to contend. Dr. Baird, in closing his remarks, made several suggestions especially applicable in New England. First, better professional etiquette; second, indirect advertising, not of individuals but of the profession; third, a legislative committee to supervise drafting of practice laws and to bring about reciprocity of practice between states of equal standard; fourth, constant opposition to the sale of nostrums; fifth, replacement of laymen by veterinarians, as milk, meat and sanitary inspectors; sixth, a better understanding and closer coöperation between the Extension Service of the states and local practitioners; seventh, constant individual effort to elevate the standard of the profession by improving the character of our work.

The first paper of the session was presented by Dr. K. M. Kennedy, Waterbury, Vermont. This consisted of a description of a number of interesting obstetrical cases occurring in Dr. Kennedy's practice, and brought out a great many practical points which should prove of assistance. Among other things, Dr. Kennedy mentioned the advisability of resorting to cesarean section before too much handling in an attempt to bring about delivery in the usual way. He stated also that in cases of torsion of the cervix, after an attempt has been made to correct this condition, if it is determined that this will result in a long, drawn-out procedure, he does not hesitate to operate through the flank. Dr. Kennedy referred also to the use of spinal anesthesia in many cases occurring in everyday practice. He feels that it is a decided aid in modern practice.

In discussing Dr. Kennedy's paper, Dr. C. F. Davis, of Rumford, Maine, told of a practical point which had been given him by an onlooker many years ago, to assist in bringing about delivery where both forelegs are presented and delivery impossible for other reasons. A pushing back of one front leg and rotating the fetus often makes possible delivery of cases which otherwise would necessitate dissection.

The next paper presented was by Dr. M. E. Maddocks, of Augusta, Maine, on "Etiology of Nonspecific Skin Eruptions." In opening his remarks, Dr. Maddocks pointed out that he had nothing particularly new to offer on the subject, but desired to bring out a discussion which might be of value to those present. Among the causes of skin conditions in dogs, Dr. Maddocks enumerated diet, digestive disturbances, climatic conditions, diabetes and sensitization to certain proteins.

The discussion on Dr. Maddocks' paper was opened by Dr. F. G. Ruder, Amherst, Mass. Dr. Ruder brought out a number of practical points and dwelt in general with treatment. He believes that he encounters cases which are due to the absorption of a toxin and also to lack of calcium and, therefore, resorts to laxative treatment in practically all types and in most cases uses parathyroid and calcium. This, of course, is carried out in addition to whatever local treatment is deemed advisable. In reply to a question, Dr. Ruder referred to a condition commonly encountered and described as dark red or blue blebs, occurring on the lips and face, which has been called angioneurotic edema. He stated that he paints these with Fowler's solution twice daily and has had very excellent results in clearing them up.

Dr. G. B. Schnelle, in discussing Dr. Maddocks' paper, referred to experiments which he has been carrying on to determine the

significance of allergic reactions in their relationship to the various skin diseases of the dog. He stated that he had used salmon, corn meal, beef, flour, rice, starch, etc. In one experiment conducted on four dogs he found all reacted to salmon and all to corn meal. Two reacted to beef and flour and two to rice. It was very interesting to note that when the animals showing these reactions were fed an exclusive diet of the food to which they had reacted, they developed severe cases of dermatitis in a very short time. Dr. Schnelle is continuing his experimental work along this line and also is attempting desensitization to whatever foodstuffs against which an animal might react.

The next speaker was Dr. J. F. DeVine, Goshen, New York, who presented the subject of "The New-Born Calf." Before entering into the subject, Dr. DeVine discussed present-day veterinary meetings as compared with those of but a few years ago. He discussed the advance which had been made in the profession and referred to a number of modern practices. Dr. DeVine, in discussing the new-born calf, first brought out the necessity of sanitary conditions and also of avoiding cold or wet quarters which are so conducive to lower vitality, resulting in infections of one kind or another. A very practical point brought out by Dr. DeVine was the necessity, in many herds, of immunizing the mothers against such diseases as calf scour, hemorrhagic septicemia, navel-ill, etc. Dr. DeVine stated that he felt that hemorrhagic septicemia was responsible for many losses in calves and was frequently overlooked, due to the fact that the symptoms presented are very different in different herds.

A short discussion followed Dr. DeVine's talk and a number of questions were asked. Following this the meeting adjourned for luncheon and reconvened at a clinic in the afternoon at the Angell Memorial Hospital.

The clinic was in charge of Drs. E. F. Schroeder and G. B. Schnelle and was held under ideal conditions. The first part of the afternoon was taken up by Dr. Schroeder, who gave a very interesting and up-to-date discourse on the diagnosis and handling of fractures in small animals. Dr. Schroeder's modification of the Thomas splint for use in high fractures proved somewhat of a revelation to most of the veterinarians present and it was regretted that more time was not at the disposal of Dr. Schroeder to carry out further the demonstrations which he had prepared.

Following Dr. Schroeder, Dr. H. E. Dailey gave a talk on diseases, care, feeding and handling of a class of animals which the

veterinarian is being called upon to treat more as time goes on, namely, rabbits, canaries, parrots, monkeys, etc. He brought out very many interesting points in connection with the diseases to which these pets are susceptible, as well as their idiosyncrasies and various successful treatments for the common diseases encountered.

Following Dr. Dailey's talk and demonstration, Dr. Schnelle demonstrated the technic of intravenous medication and discussed several interesting cases.

The evening of the first day was given over to a dinner dance held on the roof garden of the Hotel Bradford.

Tuesday morning opened with a business session. Minutes of the previous meeting were read and approved and the Secretary-Treasurer's reports were approved. Election of officers for the year resulted as follows: President, Dr. E. T. Laitinen, West Hartford, Conn.; vice-presidents, Drs. Lucius D. Perry, Saint Albans, Vt., B. S. Killian, Somerville, Mass., A. J. Neal, Bangor, Me., C. E. Swail, Colebrook, N. H., R. G. Lawton, Providence, R. I., and Cornelius Van Vlandren, Naugatuck, Conn.; secretary-treasurer (reëlected), Dr. H. W. Jakeman, Boston, Mass. Among other business conducted was the adoption of an emblem for the New England Veterinary Medical Association.

Following the business session, a paper was presented by Dr. E. T. Laitinen, West Hartford, Conn., on "Surgical Prerequisites." Dr. Laitinen's paper was most unusual in the practical suggestions and points brought out which would do much to offer food for thought along the line of surgical procedure.

Following his address, Dr. Laitinen showed moving pictures of a major surgical operation on the human, which demonstrated technic and many points brought out in Dr. Laitinen's paper.

Then an address was given by Dr. J. G. Hardenbergh, Plainsboro, New Jersey, on "Recent Developments in Controlling the Quality and Nutritional Values of Milk." This proved a very interesting discourse and showed the possibilities of placing in the milk desirable elements as a result of feeding. The discussion was opened by Dr. L. A. Paquin, Webster, Mass., and a number of questions were asked which were of a practical nature and much information was derived from the answers. Following Dr. Hardenbergh's address, he presented a moving picture of the rotolactor.

The next paper presented was by Dr. W. E. Cotton, Superintendent of the B. A. I. Experiment Station, Bethesda, Maryland. Dr. Cotton spoke on the Bang's disease problem. He first dis-

cussed the danger from drinking infected milk and stated that, considering the fact that probably one-half of our population drinks raw milk and the percentage of undulant fever cases is small, the danger of contracting undulant fever from this source is not very great.

Dr. Cotton first briefly discussed the agglutination test and compared it with the tuberculin test. He pointed out that a great deal of improvement had been made in the technic of conducting the agglutination test for Bang's disease and that the discrepancies which now occur are largely in low reactors. In discussing the modes of infection, Dr. Cotton stated that ingestion is doubtless the principal source, although the unbroken skin, the eye and the interdigital space were also possible sources. He stated that the greatest danger of infection lies in the cow which aborts. The animal which carries full time usually gives off very few organisms in the placenta. Dr. Cotton stated that the abortus organism dies in the open field in about three weeks. In wet land or swampy locations it may live very much longer.

In discussing control, Dr. Cotton pointed out the danger of visitors to farms which are endeavoring to control the disease by means of the blood test. He pointed out three possible means of control in the agglutination test, segregation and vaccination. He pointed out the necessity of vaccines of low virulence being used and that in badly infected commercial herds they doubtless have a useful place. An interesting discussion took place following Dr. Cotton's remarks.

In the afternoon another clinic was held and at this Dr. J. F. DeVine gave a lecture and demonstration on the diagnosis of pregnancy and diseases of the genital organs. Dr. DeVine, with his unusual talent for making a difficult problem simple, held the crowd at close attention and his efforts were certainly greatly appreciated.

Operations were carried out by Dr. B. S. Killian, of Somerville, Mass., and Dr. G. B. Schnelle. A number of interesting cases were presented and discussed and the clinics were voted very successful and practical.

H. W. JAKEMAN, *Secretary-Treasurer.*

WESTERN NEW YORK VETERINARY MEDICAL ASSOCIATION

The nineteenth annual meeting of the Western New York Veterinary Medical Association was held December 15, 1932, at the S. P. C. A. headquarters, Buffalo, N. Y.

A clinic was held the early part of the afternoon and consisted of cases for operation and diagnosis. Several dogs were operated upon for the removal of tumors and oöphorectomy.

The business meeting was called at 4:30 p. m. by the president, Dr. F. L. Stein. Routine business was transacted and the following officers elected for the coming year: President, Dr. H. V. Baker, Hamburg; vice-president, Dr. B. P. Wende, Buffalo; secretary-treasurer (reëlected), Dr. F. F. Fehr, Buffalo. Drs. W. C. Buck, of Dansville, and G. D. Stone, of Ellicottsville, were chosen directors for three years, replacing Drs. H. D. Martin, of Buffalo, and B. R. Wilbur, of South Dayton, whose terms expired.

Among the speakers for the evening session was Dr. W. A. Hagan, of the New York State Veterinary College at Cornell University, Ithaca, who spoke on "Food Poisoning." Dr. Hagan held that ptomaine poisoning is a bacterial poisoning and that botulism has all but been eliminated since commercial canning has been in vogue on a large scale.

Dr. C. M. Carpenter, of the Strong Memorial Hospital, Rochester, told how experiments were being carried on to kill the cells of cancer by fever produced by short-wave radio apparatus. Dr. J. G. Wills, of Albany, discussed the new regulations on the control of Bang's disease in New York state.

Dr. Frank McBride, of Tonawanda, read a paper on "Milk Control," showing how the causes of high bacteria counts in milk were immediately located and the milk supply shut off within 24 hours.

Dr. W. R. Krill, of the College of Veterinary Medicine, Ohio State University, Columbus, Ohio, was prevented by illness from fulfilling his part of the program, a talk on "General Dairy Cattle Practice."

During the afternoon the ladies were entertained by Mrs. McClelland, wife of Dr. F. E. McClelland, of Buffalo, and in the evening they attended a theatre.

F. F. FEHR, *Secretary-Treasurer.*

Christmas Dinner for Horses

For 22 years, the horses of Kansas City have been given a free Christmas dinner of oats and hay, the gift of Mrs. Emma W. Robinson. Mrs. Robinson died early in December, 1932. But the horses were not forgotten, and had their Christmas dinner as usual. The will of their benefactress included a $10,000 bequest for the "Horses' Christmas Fund." The money will be spent by the Kansas City Humane Society.

NECROLOGY

WILTON F. CREWE

The death of Dr. Wilton F. Crewe, of Bismarck, North Dakota, on November 30, 1932, closed a remarkable career and removed from among us a great leader, an outstanding public servant, and withal a veterinarian of recognized distinction.

Dr. Crewe was born, July 24, 1867, at London, Ontario, of English and Irish colonial stock. He received his primary schooling at Brussels, Ontario, and when nine years old he moved with his family to Hoboken, N. J. The lad lost his father when he was fourteen years of age and then went to live with an uncle on a farm near Crookston, Minn. Later, he moved to Winnipeg, Manitoba, where, for about a year and one-half, he was employed in a commercial establishment.

At the conclusion of this period he went to Buxton, North Dakota, where he worked on a farm until 1887, when he entered the University of North Dakota, where he remained until 1888. He then taught in a rural school in Traill County, North Dakota, and in the fall of 1889 he entered the Ontario Veterinary College, from which institution he was graduated in 1891. In the course of that year, he began the practice of veterinary medicine and surgery at Reynolds, North Dakota, where he remained until 1893, when he moved to Devils Lake, North Dakota, and there engaged in practice.

On March 7, 1909, Dr. Crewe was united in marriage with Miss Elizabeth Lincoln, of Hunter, North Dakota, who preceded him in death early in 1932. To this union there have been born two sons, Edgar Lincoln and Wilton F. Jr., who died August 11, 1928, and a daughter, Sara. He is also survived by two brothers, Dr. John E. Crewe, a physician of Rochester, Minnesota, and Percy S. Crewe, an attorney of Washington, D. C.

Almost from the very beginning of his professional career, Dr. Crewe became engaged in veterinary sanitary police work and from 1890 to 1904 he served in the capacity of District State Veterinarian. From 1904 to 1907, he was a veterinary inspector in the U. S. Bureau of Animal Industry. From April 1, 1907,

to the time of his death, Dr. Crewe held the position of Executive Officer and State Veterinarian under the then established and organized North Dakota Live Stock Sanitary Board with headquarters at Bismarck.

Dr. Crewe joined the A. V. M. A. in 1893 and retained his membership to the time of his decease. He served this organization on many occasions as Resident State Secretary and as a member of important committees. He became a member of the U. S. Live Stock Sanitary Association in 1909, in the activities of which he took a prominent part. He served as one of its vice-presidents in 1911, 1918 and 1920 and became its President in 1921. In addition, on many occasions, he was active as a member of various committees. He was a member of the North Dakota Veterinary Association since its organization, served as its President and always took a leading part in its deliberations. Dr. Crewe took a lively interest in civic affairs and was prominent in Masonry and other organizations.

From the very beginning of his professional career, Wilton F. Crewe showed evidence of marked ability and of his sterling worth. This early promise flowered into fulfillment in the course of his quarter century of continued service as the Executive Officer of the North Dakota Live Stock Sanitary Board. In that capacity he was instrumental in relieving the live stock industry of his state of its principal animal scourges: glanders, dourine, scabies and tuberculosis. By sound and just regulatory measures he protected its animal wealth against new invasions by disease. His state derived great benefits from the life's labors of this great public servant and he left it better than he found it.

Wilton F. Crewe was possessed of remarkable tact and unchallenged competence. His honesty and sincerity could always be relied on. He did his work thoroughly and without ostentation. He was a true friend of the people he served so well. A lovable companion, he inspired all who knew him. He was a man among men. L. V. E.

E. W. SCHROEDER

Dr. E. W. Schroeder, of Reedsburg, Wis., died at his home, December 5, 1932, after a long illness. He was 47 years of age. Dr. Schroeder was a graduate of the Chicago Veterinary College, class of 1911, and was engaged in private practice until about a year ago. He is survived by his widow, two sons, two daughters, two brothers and one sister.

WILLIAM P. GRIMES

Dr. William P. Grimes, of Newark, N. J., died very suddenly on November 3, 1932. He was on his way to the abattoir of Swift & Company, at Harrison, N. J., and collapsed in front of the Public Library in Newark. He was pronounced dead upon arrival at the Newark City Hospital.

Born February 25, 1870, at Liverpool, England, Dr. Grimes came to the United States as a very young boy. Following his graduation from the New York College of Veterinary Surgeons, in 1899, he engaged in general practice in New York, N. Y. In October, 1918, he entered the U. S. Army as a Second Lieutenant and was assigned to the Remount Station at Camp Meade, Md., where he served in the Veterinary Corps. On December 21, 1918, he was honorably discharged and returned to his home. He then became identified with the U. S. Bureau of Animal Industry and for over twelve years worked in Paterson, N. J. Recently he was transferred to Newark, N. J., and had but three weeks longer to serve when he would have completed fifteen years in the Department, at which time he would have been retired.

Dr. Grimes joined the A. V. M. A. in 1918. He was a member of the National Association of B. A. I. Veterinarians and the American Legion. He is survived by his widow, four daughters and four sons. C. L. H.

GEORGE B. VLIET

Dr. George B. Vliet, of Hackettstown, N. J., died on November 26, 1932. He was a graduate of the Ontario Veterinary College, class of 1891, and had practiced in Hackettstown since the winter of that year.

Dr. Vliet joined the A. V. M. A. in 1905 and had attended quite a number of A. V. M. A. conventions, Kansas City in 1931 having been the last. He was also a member of the Veterinary Medical Association of New Jersey.

ROBERT LEE HANNA

Dr. Robert L. Hanna, of Brookville, Ind., died at his home, November 28, 1932, as the result of an intracranial hemorrhage induced by a fall from a moving automobile the day before. He was in his 66th year.

A native of Franklin County, Ind., Dr. Hanna had been a resident of Brookville ever since his graduation from the Indiana Veterinary College in 1906.

Dr. Hanna joined the A. V. M. A. in 1908. His fraternal affiliations included the Masonic order, the Knights of Pythias, and the Improved Order of Red Men. He is survived by his widow, two sons, a daughter, five brothers and two sisters.

JOHN L. BEER

Dr. John L. Beer, of Chicago, Ill., died suddenly at his home, November 28, 1932, at the age of 53. He was a graduate of the Chicago Veterinary College, class of 1904, and conducted a practice at the Union Stock Yards, Chicago, for a number of years. He is survived by his widow and three sons.

ELI C. WISMAN

Dr. E. C. Wisman, of Bryan, Ohio, died suddenly, December 18, 1932, while on a professional call near Evansport. Heart failure, thought to have been induced by overexertion and exposure to the cold, is believed to have caused his death.

Dr. Wisman was a graduate of the Ontario Veterinary College, class of 1895, and had been located at Bryan ever since. In 1919 he was appointed postmaster and served in this capacity for eight years. He was a former chairman of the Williams County Democratic Committee. He is survived by his widow, one daughter, one sister and three brothers.

JAMES F. ADEE

Dr. James F. Adee, of Topeka, Kansas, died December 24, 1932. He had been confined to his bed for some time as the result of a heart ailment.

Born at Wells, Kansas, May 25, 1887, Dr. Adee received grade and high school education. He saw military service during the World War and was wounded while over-seas. At the close of the War he entered Kansas State College and took up the study of veterinary medicine. In spite of physical handicaps, the result of his war injuries, he completed the work necessary for his degree in veterinary medicine, in 1923. He entered practice at Stansberry, Mo., but during recent years had been employed as a member of the staff of the Kansas State Dairy Inspector. He was considered one of the most thorough and conscientious officials in the state.

Dr. Adee joined the A. V. M. A. in 1924. He is survived by his widow and three children. R. R. D.

ADDISON M. STROCK

Dr. A. M. Strock, of Troy, Ohio, died November 7, 1932, after an illness of two years. He was in his 84th year. He was a registered non-graduate practitioner in Ohio. He attended one session at the College of Veterinary Medicine, Ohio State University, in 1891, but did not complete the course.

Our sympathy goes out to Dr. A. J. Savage, of Colorado Springs, Colorado, in the death of his wife, September 25, 1932.

PERSONALS

MARRIAGES

Dr. A. C. Etchison (Chi. '10), of Assumption, Ill., to Miss Melba Hall, of Taylorville, Ill., December 18, 1932, at Taylorville, Ill.

Dr. Walter W. Thompson (Mich. '29), of East Lansing, Mich., to Miss Beulah L. Shuey, of Battle Creek, Mich., September 17, 1932, at Battle Creek, Mich.

PERSONALS

Dr. R. G. Moore (Iowa '13), of Dunlap, Iowa, was elected to the Iowa Senate at the November election.

Dr. F. R. Whipple (McK. '02), of Chicago, Ill., spent several weeks of December as a hospital patient, suffering from a heart ailment.

Dr. James S. Kelly (Ont. '91), who retired from government service some time ago, is now in the insurance business, in Tacoma, Wash.

Dr. Lloyd Diehl Jones (Iowa '31), of Rochelle, Ill., joined the staff of the North Shore Animal Hospital, Evanston, Ill., on December 20.

Dr. Nathan K. Fegley (Nat'l. '95), of Emaus, Pa., has retired from active practice.

Dr. J. C. Brown (Ont. '15), of Lansing, Ont., had his right shoulder fractured recently.

Dr. E. R. Braun (Wash. '29) has been transferred from Huntington Park, Calif., to San Anselmo, Calif.

Dr. J. L. Flanigan (McK. '14) has removed from Fort Defiance, Ariz., to Aztec, N. M.

Dr. A. H. Craige (U. P. '32) is assistant in physiology at the School of Veterinary Medicine, University of Pennsylvania.

Dr. J. E. Murphy (Ind. '23) recently opened an office for general practice at Chippewa Falls, Wis.

Dr. E. A. Caslick (Corn. '22), who is located at the Claiborne Stud, near Paris, Ky., recently underwent a tonsillotomy at the local hospital.

Dr. F. J. Olbrich (Iowa '22) reports a change of address from Philadelphia, Pa., to Blackwood, N. J.

Dr. F. H. Callahan (K. S. C. '29), formerly of Shelton, Nebr., is now located in Sacramento, Calif.

DR. J. A. FORD (Ont. '10), formerly of Santa Paula, Calif., is now located at 2528 E. Slauson Ave., Huntington Park, Calif.

DR. HARRY CALDWELL (Chi. '05), of Wheaton, Ill., had quite a loss from a roof fire that did considerable damage to his hospital on December 15.

DR. G. E. BOTKIN (Ind. '12) was the principal speaker at the December meeting of the cadet division of the local Y. M. C. A. Boys' Department. Dr. Botkin spoke on the care and treatment of pets.

DR. JOHN W. JACKMAN (O. S. U. '19), of Columbus, Ohio, has been appointed a member of the Ohio State Board of Veterinary Medical Examiners by Governor White.

DR. ROBERTO PLATA GUERRERO (U. P. '20) is Director of the Escuela Nacional de Medicina Veterinaria of Bogota, Colombia, and Professor of Parasitology and Infectious Diseases, in that institution.

DR. W. A. AXBY (Ohio V. C. '95-Cin. '05), of Harrison, Ohio, addressed a recent meeting of the Brookville (Ind.) Kiwanis Club, on the subject of "The Relation of Human Infection to Animals and the Milk Supply."

DR. H. A. SMELTZER (Gr. Rap. '12), formerly connected with the Wisconsin Department of Agriculture, has entered practice at Fremont, Wis.

DR. LESTER C. NEER (O. S. U. '19), for eight years with the Division of Health, Bureau of Food Inspection of Dayton, Ohio, recently was appointed food, meat and milk inspector of Middletown, Ohio.

DR. C. A. HENLEY (O. S. U. '25), of New Berlin, Ill., addressed a meeting of the Jacksonville (Ill.) Lions' Club the latter part of November. He spoke on a variety of topics in the field of veterinary medicine.

DR. C. H. HAASJES (Gr. Rap. '18), of Shelby, Mich., delivered a radio address on "Parasite Control" over the broadcasting station located at Ludington, Mich., about the middle of December.

DR. T. O. BRANDENBERG (Corn. '13), of Lakota, N. Dak., has been appointed Executive Officer and State Veterinarian, North Dakota Live Stock Sanitary Board.

DR. A. F. NELSON (Ind. '01-Chi. '02) was reëlected to the General Assembly of Indiana at the recent election. Dr. Nelson represented Boone County in the 77th General Assembly, as well as the special session of the legislature held recently.

DR. L. F. NEUENSCHWANDER (O. S. U. '32), of Attica, Ohio, addressed the winter meeting of the Farmers' Short Course held at Attica, December 21, on the topic, "Influence of Parasites and Diseases in Increasing the Cost of Producing Pork."

DR. J. W. BENNER (K. S. C. '11), who has been Assistant Professor of Special Research in Animal Diseases at the New York State Veterinary College, Cornell University, for a number of years, is now located at Fontana, California, with the Fontana Farms Company.

DR. CLARENCE L. BARNES (Corn. '00), of Poughkeepsie, N. Y., was injured by a cow, the early part of December, while administering the intradermal test to the animal. Dr. Barnes was confined in a local hospital with a severe infection of one foot, which resulted from the injury.

DR. GEORGE H. BERNS (Col. '79), of Brooklyn, N. Y., narrowly escaped more serious injuries, when he fell over a bannister at his home the early part of December, sustaining a severe concussion of the brain and a dislocation in the lower lumbar region. Word received the latter part of December indicated that he was making a good recovery.